SCIENTIFIC AMERICAN

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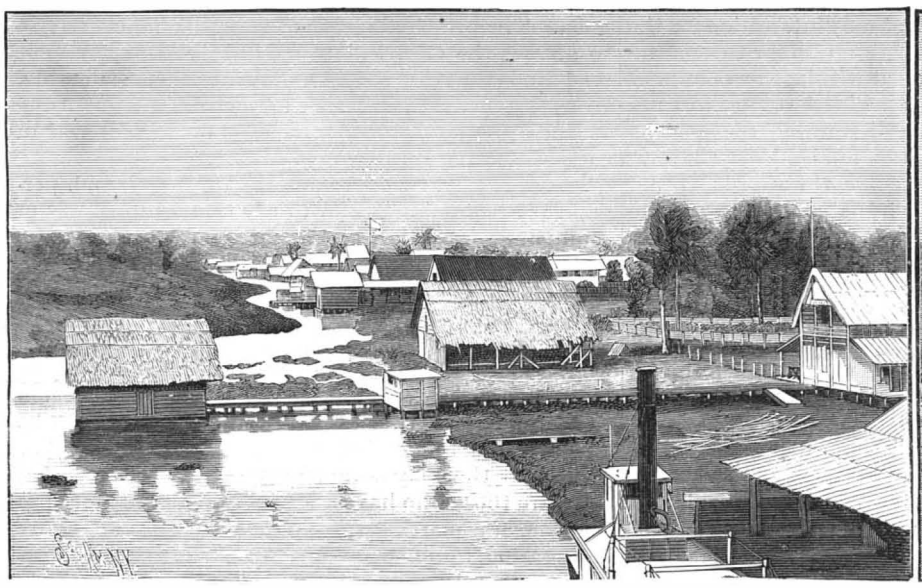
THE NICARAGUA SHIP CANAL.

Every discouraging report, for the past year or two, touching the probability of the completion of the Panama Canal, commenced by M. de Lesseps, has caused public attention to be yet more earnestly attracted to the Nicaragua Ship Canal project. The great difficulty and the enormous cost of the work thus far done at Panama has compelled those interested in the Nicaragua route to be extremely thorough and careful in their surveys and estimates, which have been completed with a detail that is in marked contrast with those previously made for the Panama Canal; and now that the plans for the latter have been changed to make it a lock canal instead of a tidewater cut, all the advantage that was ever claimed for the latter, as against the more northerly route, has been surrendered. When to this is added the fact that the financial state of the Panama Company now seems to have become desperate, it is obvious that the successful progress through Congress of the bill incorporating the Nicaragua Maritime Canal Company becomes a matter of the highest importance.

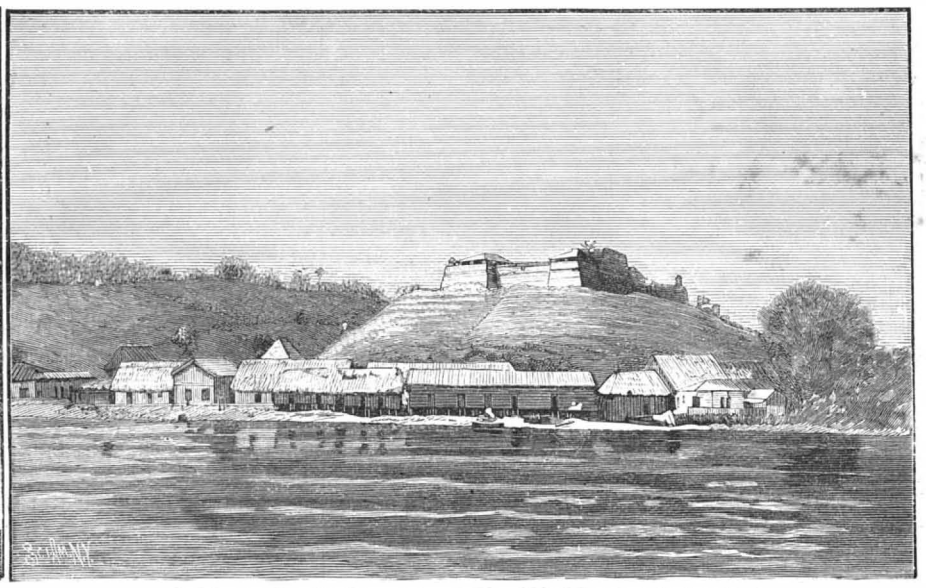
The bill incorporating the company was originally introduced more than a year ago, but was encumbered with so many amendments touching the amount of stocks and bonds the company might issue, and the manner of issuing them, and various other

(*Continued on page* 105.)

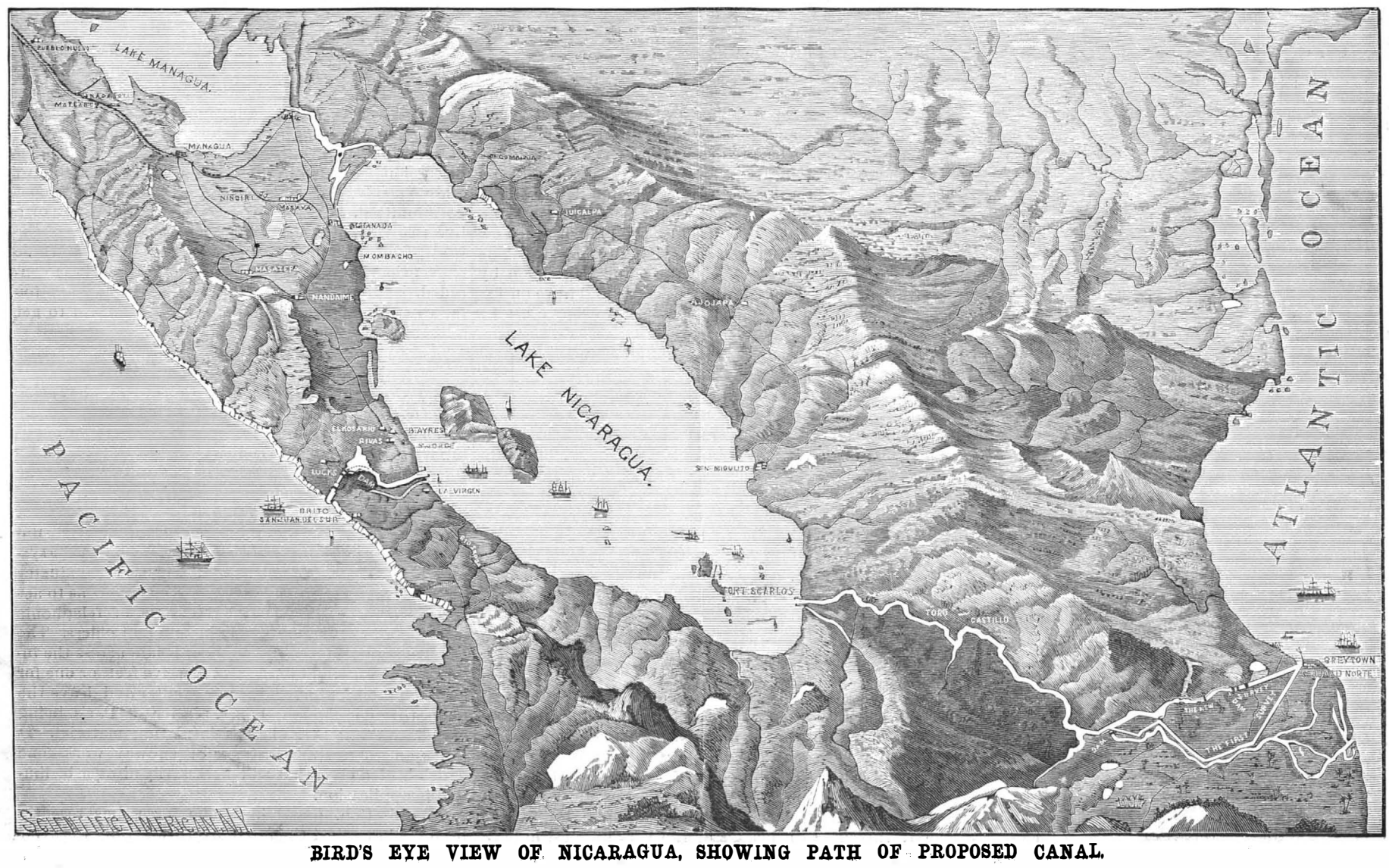
NATIVE HUT.



GREYTOWN, ATLANTIC TERMINUS OF CANAL.



OLD SPANISH FORT CASTILLO, ON RIVER SAN JUAN.



BIRD'S EYE VIEW OF NICARAGUA, SHOWING PATH OF PROPOSED CANAL.

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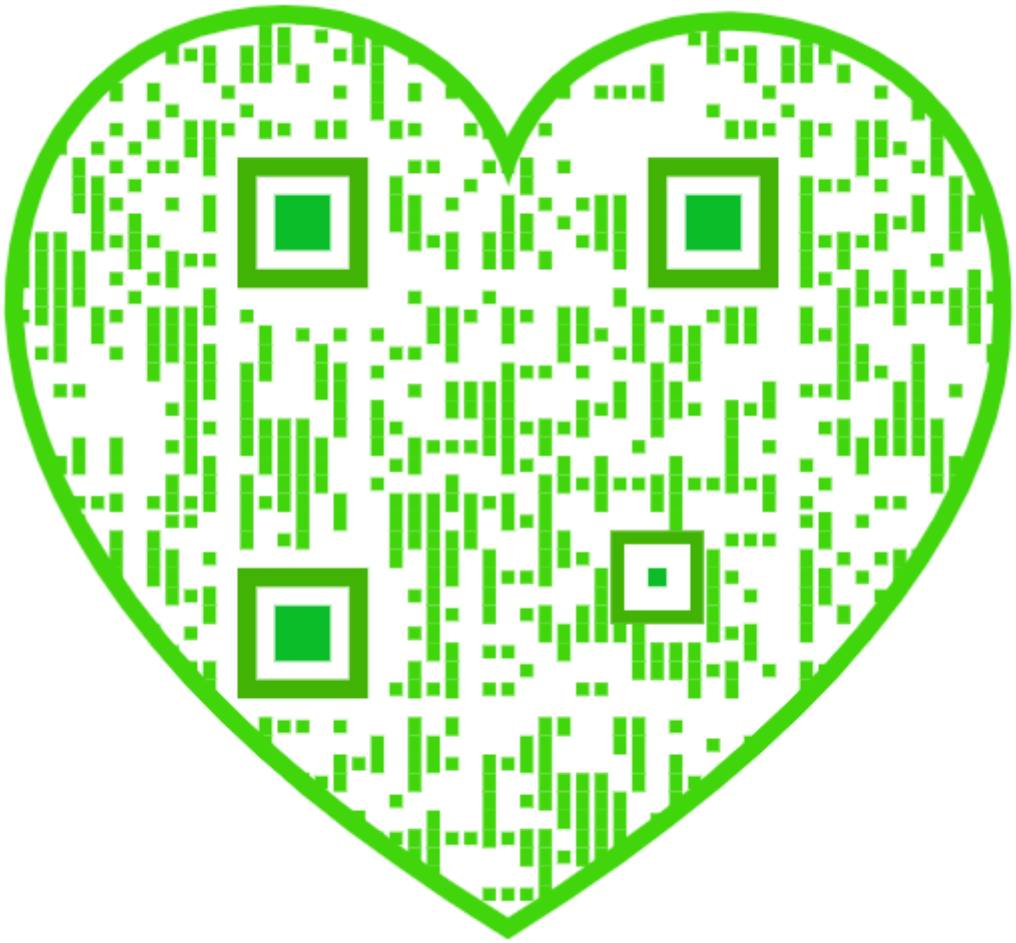

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NEW YORK, SATURDAY, FEBRUARY 16, 1889.

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THE CELESTIAL WORLD.

A STARRY LOZENGE.

An interesting geometrical figure may now be traced in the heavens on starlit nights. It is an irregular lozenge formed by four stars of the first magnitude. Sirius, which is on the meridian about 8 o'clock on the last of February, may be taken as the starting point, occupying the southeast corner of the figure. A line drawn northwest from Sirius will lead the eye to Betelguese in the shoulder of Orion. Rigel, in the foot of the mighty hunter, is opposite Betelguese, and a line extending from Sirius through the belt of Orion will reach Aldebaran in the constellation Taurus. These four stars—Sirius, Betelguese, Rigel, and Aldebaran—form the corners of the celestial lozenge, a figure which once traced will never be forgotten, and whenever on winter nights the eye is turned toward the sky, the superb combination will be recognized.

Each star of the shining quartet has a history. Sirius shines with a transcendent luster, so far exceeding all other stars of the first magnitude that it seems to belong to a class of its own. It is a white star, rejoicing in the glory of its highest period of development, its *grande jeunesse*. It is made specially interesting by the discovery, in 1862, of a dark companion star. Betelguese, the leading brilliant in Orion, is a singularly beautiful star, in color a rich topaz with a reddish tinge. It shines with an irregular light, for, like our sun, it is a variable. Rigel is a brilliant star, its light in striking contrast with that of Betelguese. It is a noted double, the companions being pale yellow and sapphire blue.

Aldebaran is the brightest star in the constellation Taurus, and resembles Betelguese in color. It is a double star, with a minute companion. It is frequently occulted by the moon, for its position in the heavens is in or near her path.

This geometrical figure is not only interesting for the brilliants that form its corners, but also for the charming collection of stars contained within the boundary lines. The whole constellation of Orion, first in rank among all the clusters of stars, here finds place. The observer will perceive with the unaided eye the belt symmetrically placed in the center, the sword slanting downward from the belt with its nebulous star, and the irregular parallelogram made up of the four brightest stars—Betelguese, Bellatrix, Rigel, and Saiph.

The telescopic observer has a rich field for study in this marvelously beautiful constellation, abounding in double, triple, and quadruple stars, variables and nebulæ. A powerful instrument transforms the nebulous star in the sword into the Great Nebula of Orion, the most impressive and awe-inspiring vision of celestial loveliness that the boundless star depths reveal to mortal sight.

It is sometimes difficult to trace stars by triangulation or alignment, the surest way of impressing them upon the memory; but the stars forming the combination here described come into view at a glance without exertion on the part of the observer, with the radiant gems they inclose, draw forth a spontaneous tribute of admiration for the exceeding beauty of this portion of the star-spangled firmament.

PROGRESS OF NEW ARMAMENTS.

The Secretary of War has awarded a contract to the Pneumatic Dynamite Gun Company for seven guns for coast defense. Five are destined for the defense of the harbor of New York.

The contract calls for three guns for Sandy Hook, two for Fort Schuyler, and two for Fort Warren, Mass. All the peculiarities presented by the 15-inch gun now mounted at Fort Lafayette are virtually specified. The guns must be capable of elevation and depression by either pneumatic or hydraulic power, and have an extreme elevation of at least 35 degrees. They must be capable of an all-around fire, or through 360 degrees, the training and elevating to be wholly under the control of the gunner in charge. The range of fire is also specified, the extreme demanded being a mile Rapidity of fire is also called for, being a requirement not demanded in the recent tests of the stationary gun. The delivery of the guns ready for mounting must be made within eight months of the time of execution of contract. The sum of money as bid by the Pneumatic Dynamite Gun Company is $395,500.

The guns will be able to deliver upon an enemy projectiles that contain 500 pounds of dynamite, the explosion of which, on or close to the strongest ironclad ship now afloat, would knock down every man on deck, and probably sink the vessel. Our new torpedo boat Vesuvius, 725 tons, is armed with these guns, and, speaking of her recently, the *Engineer*, London, says: "We may allow something for pardonable exaggeration, and still we have enough left to induce the belief that Uncle Sam has got hold of a craft which an ironclad would not care to fight for the fun of the thing."

The New York *Times* says: "The success of the Vesuvius has contributed to the success of the dynamite gun, inasmuch as vessel and gun appear inseparable. This dual success is looked upon by foreign governments as a matter of the very greatest importance, and military men in this country feel sure, from the number of emissaries of foreign governments now in this country inquiring into the features of gun and vessel, that Italians, Russians, Spaniards, and French will have dynamite guns in their coast defense system before many months have passed."

A successful trial of a new cast steel gun was made at Annapolis, Md., on the 7th inst. Two rounds were fired with a charge of thirty-six pounds of powder to set the gas checks and warm the gun. At 2:15 P. M. the first round with a full charge was fired. The shell struck the butt with great force, throwing up much mud, but the gun was uninjured. After sponging, the gun was loaded again, and in two minutes the second round was fired; the gun was still as solid as ever. Eight other rounds were fired at intervals of about two minutes, with complete success. This is the first high-powered American cast steel gun that has successfully passed the test of ten rounds with full charge delivered rapidly.

It will be remembered the first gun of this character burst on its trial. Both guns were made of open hearth steel and were cast by the Standard Steel Casting Company, of Thurlow, Pa. The gun tested on the 7th is 195 inches in length; diameter at breech, 22 2 inches; diameter of chamber, 4 5 inches; diameter of bore, 6 inches; weight of gun, 13,125 pounds; weight of shell, 100 pounds; weight of charge, 48¼ pounds.

MEETING OF ELECTRIC LIGHT MEN.

The National Electric Light Association meets at Chicago, in the Exposition Building, on the 19th, 20th, and 21st instants, and, from what can be learned, is likely to be more than usually interesting. There will be at the same time a large exhibit of electrical and kindred apparatus, the most interesting of all, perhaps, a 900 foot track, with curves of 90 feet radii, on which it is expected the various types of electric motors will be tried. The principal magnet—we speak figuratively—to attract the electrical men will be the papers to be read and the discussions following them; notably, "Current Meters," "Static Charge in the Puncturing of Underground Cables," "Relation of the Material of Conduits to the Insulation of Cables."

These discussions are unique in their way, and, perhaps, it is not going too far to say that the manner of conducting them is quite as novel as the apparatus which is their inciting cause. At the meeting of scientific associations—there are exceptions, of course—one must needs listen to much which, though often good and sometimes true, is not always new, and again to what is new, but neither instructive nor entertaining; for, as in a society of artists, there is the old academician, who is *hors concours*, and whose pictures must be accepted and hung "below the line," whether good or bad, so in the long established scientific association there are those who have the right to talk, to occupy the time of a meeting, whether or no they have any information to impart. But, in the electrical field of to-day, apparatus and methods change so quickly that a new device or idea is scarcely arrived when that which is still more novel is treading upon its heels.

The electrical men come from all parts of the country at stated intervals to compare notes concerning these; it being of vital importance, and by no means an easy task, to keep abreast of all that is going on in a particular line. There is no time for idle talk, for oratory, for ancient history, for dissertations on things in general, with an occasional remark on the subject under discussion. The chairman has no traditions to follow, and no mercy; the committee, to whom all papers must be submitted, rarely pass one that does not treat of a live issue. When it is remembered that many of the best practical minds of the country gather at these conventions, and that in their line they are, it is conceded, leading the world, it is not, perhaps, going too far to say that to attend these conventions is to get a liberal education in applied electrics.

ELECTRIC WIRES IN GAS MAINS.

The Consolidated Gas Light Co., of this city, some years ago, in laying a gas main, took advantage of the opportunity to introduce a telephone line in it, suspending it from insulators within the main. Excellent results were attained. On recently opening the main the wire was found to be coated with naphthalene, but the line as such was intact. Such a line is proof against the severest blizzards, and insures communication under all conditions. Recently they have extended the system, and have laid about five miles of three-conductor lead-covered lines within some new mains, so as to act as a basis for quite a complete system of telephonic intercommunication between the different offices. The wires are supported by short boards laid across the interior of the main at intervals of twelve feet, or one for every length of pipe. The wires enter and leave the main through stuffing boxes, plaster of Paris being used as packing and glass as insulating material. It forms an interesting instance of subway work—one which is of a class that will necessarily always be limited in application.

An objection, possessing some force, has recently been made against the use of overhead trolly lines for electric railways. It is to the effect that these lines,

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necessarily of bare wire, are a perpetual menace to person and property. If an ordinary telegraph wire falls or sags so as to cross one of them, it may readily carry off current enough to set a building on fire, or to injure or kill some person. The most obvious remedy for this state of things is to use an underground line or storage batteries. The danger may be modified and diminished by using current of low electro-motive force. This will reduce the danger from incandescence, or arc formation, and may make the current almost innocuous in its effects upon the human system. The gas main system just spoken of certainly is an example of a safe method, though unfortunately inapplicable to industrial uses. The slotted subways as used for electric railways are also apparently quite safe in character, whether high or low tension currents are used.

The Paris Exhibition.

(FROM OUR SPECIAL CORRESPONDENT.)

PARIS, January 17, 1889.

American exhibitors of small tools ought to reap a good harvest at the Paris exhibition, not only because their tools are superior, but also because they are beginning to be recognized as superior in France as well as in England. Yesterday I saw, in the exhibition buildings, a French carpenter using, among other tools of American origin, a Backus brace for bits, augers, etc., which, in the course of conversation, I found he praised highly, supposing it to be a French tool, and so perhaps it was, as far as its make was concerned, but the design was the Backus pure and simple; indeed, it had the ratchet movement and the patent angular wrench attachment complete.

In the course of my experience, both here and in England, nothing has struck me so forcibly, as far as mechanics are concerned, as the superiority of American small tools.

I do not expect this superiority to be brought out very strongly at the Paris exhibition, so far as the exhibits are concerned, for Europe is in a somewhat peculiar position in this matter, which arises, in the first place, from the conservatism of the masses, and in the second, perhaps, from the apathy of Americans with regard to foreign trade. But let the causes be what they may, the facts are as follows: Tools of American design, if not always, nor even often, of American make, are to be found in the better class of both English and French tool sellers' shops, and they are highly recommended by the salesmen. They are, therefore, certain to be found among the exhibits at the exhibition. But it is not always, nor even often, that they are to be found in the ordinary workshop or the hands of ordinary workmen. Now, in the case of those that are made in the United States and imported here, the cost may have something to do with this, but that cannot be the case with the English and French copies of American tools.

It is quite true that both these copies are, as a rule, not up to the American standard as regards either fit or finish, and are sometimes mere travesties of the originals. The fact remains, however, that the great mass of workmen here have little or no acquaintance with the advantages of these tools; but at such exhibitions as this they get an education that will create a demand for the best, and I feel quite sure that with a sufficient demand to make it worth while, American small tool makers could compete with their rivals here in their own markets, and that there is enough demand now to make a good representation at this exhibition a sound commercial venture.

There is, however, another and important consideration in this connection, inasmuch as that in proportion as American tools become known here as of American origin, French patents will increase in value to American inventors, and there is in my mind no doubt that European patents will become of more value to Americans every year.

There are some American tools that are so far superior to either French or English that it is altogether astonishing that they have not been copied, and threading tools may be taken as an example. Sir Joseph Whitworth, to whom the mechanical world owes so much, by making a specialty of threading tools, adopting a standard form of thread, and using standard gauge diameters, some forty or more years ago, managed to control the screw tool trade of Europe, and it has remained pretty much as he first introduced it, in all countries save in the United States, where the fallacy of three flutes in a tap or three cutters or chasers in a die head is pretty generally known. I forbear further remarks on this head, however, until I have the French, English, and American exhibits before me.

France, like England, has, as far as I can at present see, failed to appreciate the boon America gave to machinists in the form of the emery wheel, and as a result has, at the same time, failed to appreciate the full value of the milling machine. The French, like the English, have, to a certain extent, adopted and copied the Brown & Sharpe universal milling machine, and they have, to a certain extent, adopted the emery wheel; but it is sufficient to illustrate my point to say that in a shop of five hundred men I have seen milling cutters softened and filed up to resharpen them, and I could enumerate many other similar circumstances, all pointing to the fact that there is a field here for American tools and American information as to how to use them.

Some time ago I went into a large and important technical institution, and found them using flat drills, and was told by the students that they could not use twist drills because they "fired." On being asked to show me one that had "fired," he brought from a tool chest a ¾ inch twist drill that had been ground on a common grindstone, the two cutting edges being at a different angle, and one side being longer than the other, while the high corner was worn completely off. Upon being asked to try the drill in my presence, he put it into a machine, ran it at a speed that was not above one-quarter fast enough, and tried to force it to cut until sparks of fire flew out and the drill softened at the end. When I ground up the drill (removing the softened point), and ran it at a proper speed, he was amazed at its work, and said he had "often wondered how the Americans made them work."

There are not wanting here, as well as in England, men who claim that the twist drill is not an American invention; that they had used such drills years before the American patent was issued. The trouble with these men is that they do not know what a twist drill is, and call their blacksmith-twisted drill, with a flat end, a twist drill, whereas it fills only one of the requirements of a twist drill, and even that one very imperfectly.

If exhibitions such as this one at Paris came every two, instead of every ten, years, American small tools would make a revolution in European workshop practice, but as it is, it will be a matter of time, unless some good missionary work is done.

The machinery department is progressing rapidly.

Waxed Paper Bags.

A new article called "The Sparks' Waxed Paper Bag" is now being extensively introduced, and is noticeable for its novel qualities. The exterior is like any paper bag, but the interior surface is lined with a thin film of fine paraffine wax, which renders the bag substantially air tight and water proof. The cost is but a trifle more than the common paper bag.

Tobacco, snuff, cigars, etc., put up in these bags are preserved in perfect condition, drying and loss of aroma being prevented. In like manner, confectionery, fruit, and other eatables are kept intact, wholesome and fresh. As these bags may be made translucent, they render the package attractive, and this adds a desirable selling quality, independent of other merits. Druggists use them for enveloping all kinds of preparations; grocers find them very desirable in preserving, in fresh condition, coffee, tea, dried beef, hams, cheese, sugar, and other foods. The difference between two packages of coffee, one put up in the ordinary paper bag and the other in a Sparks' waxed paper bag, is very striking. A pound of coffee in ordinary paper, when brought into a room or car, is scented by everybody at once; but if the waxed paper bag is used the contents cannot be detected; there is no escape of aroma, the preservation is complete. These waxed paper bags are also found to be of superior value for wheat, flour, buckwheat, oatmeal, Indian meal, etc. The contents are kept fresh, and access of moisture or other contamination is prevented. For packing cement, fertilizers, etc., the bags are also useful.

Furs stored in these bags with the smallest quantity of camphor or other insecticide are rendered moth proof. Valuable clothing may, in like manner, be conveniently preserved.

The waxed paper bags are now made by millions, of all sizes and grades, by the Sparks Manufacturing Company, 24 Burling Slip, New York, where they have a large establishment devoted to the manufacture of the above, and waxed papers of every description.

Trial of the Fifteen Inch Dynamite Gun.

The largest of the pneumatic guns yet made, and of the model designed for the new cruiser Vesuvius, was given an official test at Fort Lafayette, on January 26, in presence of the naval board of ordnance appointed for this purpose by the U. S. government, consisting of Commander Casper F. Goodrich, Lieuts. Bradley A. Fiske and Seaton Schroeder.

Among the many close observers of this important trial were the Baron Von Sternberg, of the German Legation, and Capt. Pickowski, of the Imperial German Army; Lieut. Fulton, U. S. N.; Lieut. Carden, U. S. Revenue Marine; Capt. Birney, U. S. Ordnance Department; Lieut.-Col. W. R. King, Commander at Willets Point; and U. S. Commissioner Morle, Chas. F. Emery, and others, Capt. Zalinsky taking active charge of the manipulation of the gun.

By prearrangement, the marking buoys were to be 50 yards apart, in the line of fire, at a mean distance of 2,138 yards, and the target area was to be a rectangle 150 feet by 50 feet, located on the east side of the channel in Gravesend Bay. Owing to the loss of one buoy, it was decided that the first shot should mark the target center.

The shells used in the trial were all of the sub-caliber class, with peripheral wings, the shells being 8 inches in diameter, with sectional guides and follower of wood, the air closure being of leather, cupped, as used for hydraulic plungers.

The hazy atmosphere and clouded sky interfered somewhat with exact observations. The firing commenced at 11:10 A. M. with a range shell charged with sand, striking at 2,138 yards.

The first trial shell, charged with 175 pounds dynamite, was delayed a few minutes by vessels sailing across the line of flight, being fired at 11:23. Time, 13 seconds; range, 2,048 yards, falling short of the target and throwing the water in a vertical column about 200 feet high. Range correct, but the shot fell short of the rectangle of target.

The second shot, with a charge of 175 pounds dynamite, was sent on its errand at 11:38. Time, 14 seconds; range, 2,032 yards. This shell seemed to explode deeper in the water, as observed by the greater volume of water thrown up. It fell short of the target.

The third shot at 12:5, with nearly the same effect as the last. Time, 14 seconds; range, 2,140 yards; striking and exploding deeply within the target area.

The fourth shot at 12:17. Time, 12½ seconds; range, 2,138 yards. Exploded within the target.

Fifth shot at 12:25. Time, 12 seconds; range, 2,160 yards. Exploded beneath the target area.

Sixth shot at 12:35. Time, 13 seconds; range, 2,114 yards; striking within the target area, exploding at a still greater depth, as observed by the great volume of water thrown up.

Seventh shot at 12:40. The charge in this shell had been increased to 201 pounds of dynamite and nitro-gelatine. Time of flight, 14 seconds; range, 2,108 yards; falling just out of the target rectangle.

The increased area of effective action of the shells was now plainly to be seen by the increased volume of the water, which was thrown to a height of between 200 and 300 feet, the extension of the *delay primer* causing the shell to sink deeper into the water before the final explosion.

The eighth and last shot at 12:50, with an extra time delay primer, proved the ability to control the time of the final explosion after the shell touched the water. Time, 13 seconds; range, 2,180 yards, and beyond the target. The explosion of this shell produced a magnificent effect, the delay primer allowing the shell to sink deeply into the mud at the bottom of the bay. The upheaval was a vast black cloud of mud and water over 150 feet high, and apparently of much larger area than the limits of the target or of any previous explosion.

The trajectory of the shells was easily observed during their entire course, and together with the singular tone of the air discharge and whistling of the projectile, seemed to heighten the scene to the realms of war.

Shells of full caliber, to contain charges of 500 to 600 pounds of high explosive, are in preparation for future trials.

The pressure in the air cylinders during the firing was about 1,000 pounds per square inch, reduced in the gun to about 600 pounds, or a total pressure of over 50 tons.

The result of this initial test in the percentage of accuracy is certainly surprising, and most satisfactory in its bearings upon the long discussed question of national defense.

That 50 per cent of the shots were intensely effective within the area of an ordinary sized ship, and 75 per cent within the area of the largest war ship, while the poorest shot would have a demoralizing effect upon an enemy by its close proximity, is an accomplishment that we may all be proud of, and which may be considered a long step forward in the defense of our harbors and coast.

C. H. Delamater.

Cornelius H. Delamater, founder of the Delamater Iron Works, of this city, died of pneumonia on the 7th inst., at his residence, 424 West Twentieth Street. Mr. Delamater was born at Rhinebeck, on August 30, 1821, and came to New York as a boy of 14 to earn his living.

His first employment was in Swords' hardware store. At 21 he became a clerk in the Phœnix Iron Works, Canal and West Streets. Three years later, in 1842, his employers retired, and young Delamater and his cousin, Peter Hogg, formed a partnership and carried on the business. In 1850 they removed to the foot of West Thirteenth Street, where the Delamater Iron Works now stand. Mr. Delamater became sole proprietor.

In the war times he built the turreted ironclad Dictator, and he did a good deal of other work for the navy.

Mr. Delamater was very active in the Society for Mechanics and Tradesmen. He was one of the first members of the Union League Club.

A WELL recently bored for gas at Pittsburg delivers fresh water, salt water, and gas at same time. There are two casings, one within the other; the outer one, 100 ft. down, taps a fresh water stratum, while the inner pipe reaches the salt water and gas at 200 feet down.

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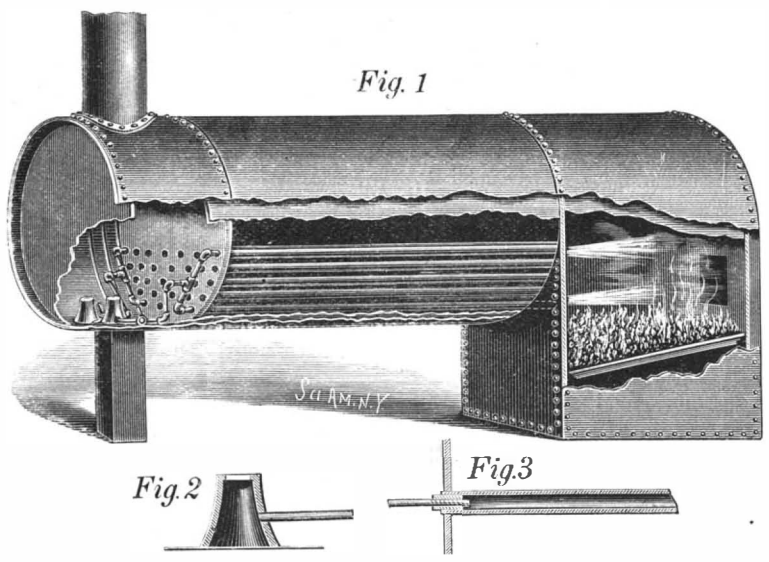
AN IMPROVED LOCOMOTIVE BOILER.

An attachment for locomotive and other boilers, in which the draught is urged by the exhaust of the engine, and the combustion of the fuel improved, is illustrated herewith, and has been patented by Mr. Charles S. Smith, of Pocatello, Idaho Territory. In a boiler of the ordinary locomotive type, as shown in the illustration, a pipe is connected with each of the exhaust nozzles, at points near the bases of the nozzles, as shown in Fig. 2, whereby a portion of the exhaust will be received and conducted to two of the tubes on each side of the boiler. The pipes from the exhaust nozzles are connected with T's, short pipes from which enter the smoke box end of the boiler tubes, to the ends of which they are fitted by bushings, as shown in the sectional view, Fig. 3. The steam thus passed to the fire box from the exhaust becomes heated to the temperature of the water in the boiler, its decomposition in the fire box greatly assisting in obtaining a higher degree of heat, while the force with which it enters causes the sparks and cinders to fall back, preventing them from passing into or through the tubes, and insuring a more complete combustion of the fuel.



SMITH'S LOCOMOTIVE BOILER.

ELASTIC ENGINE FOUNDATIONS AND SUSPENSION OF VEHICLES.

The complete and stable isolation of structures, machines, and vehicles, with a view to deadening shocks, preventing the transmission of vibrations, and diminishing the resulting noise, is a problem which has received a large number of solutions, none of which has hitherto given full and entire satisfaction. The processes employed for the isolation of machines consist in the use of rigid foundations or elastic substances. Masonry foundations, even with the superposition of framework, and surrounded with trenches, have proved insufficient.

The interposition of rubber has given good results in some cases but unsuccessful ones in others, and the causes of which are thus set forth by Mr. G. Anthoni in a recent communication to the Society of Civil Engineers:

"Rubber simply interposed between the floor and the tool to be isolated has been used for a long time, and gives good results, because the isolation is complete, but it can rarely be utilized thus because there is no stability, and movements may be produced that interfere with or are even dangerous for the service. Besides, in impact tools, the useful effect is diminished.

"If, in order to overcome such inconveniences, we connect the piece to be isolated by bolts, the vibrations pass through the latter, and the isolation is destroyed. Moreover, if we compress the rubber in order to give stability, there is no more elasticity, and if, on the other hand, we do not compress it, but allow it to retain all its elasticity, we do not obtain the stability in view of which the connecting bolt is used.

"Want of success may be due also to the improper use of rubber, for, in order to solve a problem of isolation, we must study the conditions that have to be fulfilled by the blocks from the standpoint of their form, surface, and thickness."

In order to leave rubber its entire elasticity, and to give the isolated system all the stability necessary, Mr. Anthoni has recourse to two methods, which at the same time secure isolation and stability: (1) An increase of the mass of the system to be isolated, and (2) an isolating and elastic attachment.

The first of these is applied to the foundation of machines, while the second is more especially designed for the suspension of vehicles of all kinds.

As an example of an elastic foundation for a collection of machines, we may cite the small central electric works established by Mr. Pulsford in the Faubourg St. Denis. The vibrations of these machines were annoying the neighbors considerably, and lawsuits were imminent, when Mr. Juppont, Mr. Pulsford's electrical engineer, conceived the idea of having recourse to Mr. Anthoni's method. The accompanying figure shows the application that has been made of it, and which is giving entire satisfaction.

A large oblong ditch was dug, the bottom of which was provided with a floor and a sheet of iron plate over which was distributed a certain number of rubber disks which formed an insulation at once electric and elastic. Upon these disks was laid a second iron plate riveted to a flooring that rendered the plate indistortable. It is upon this flooring that the foundation is built, places being left, of course, for the foundation bolts, and spaces being reserved sufficiently capacious to allow of the periodical cleaning of the ditch and for the accumulation of debris between two successive cleansings without interfering with the elastic suspension.

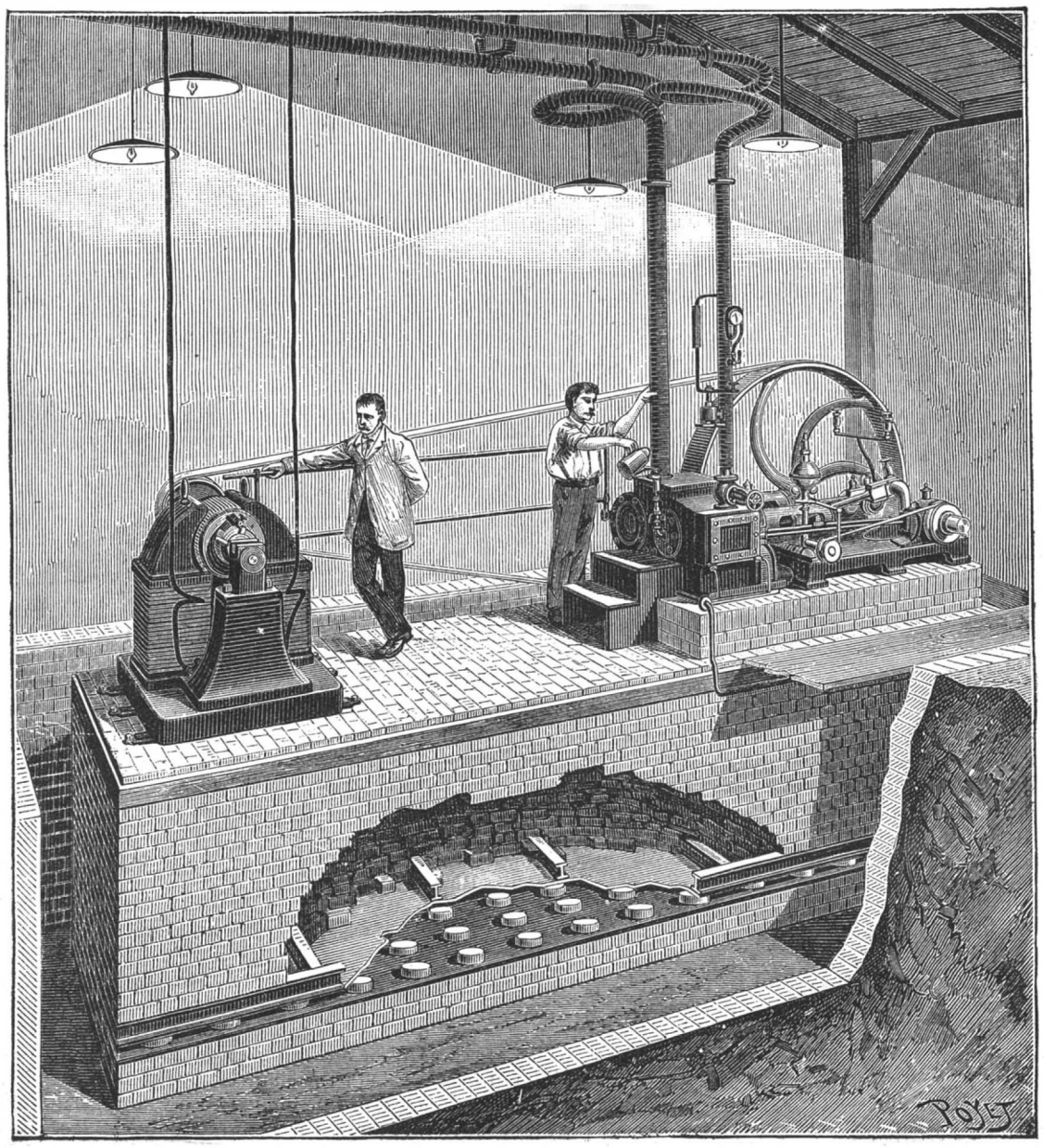
The foundation need not be of masonry, and in some cases it may be advantageous to use a caisson filled with sand, thus permitting of the easy shifting of the foundation. The trench is covered with a flooring or iron plate permitting of the motions of the masonry in a horizontal direction if it is a question of a steam engine, or in a vertical direction if the elastic suspension is applied to a steam hammer or a pump.

The steam admission and eduction pipes are wound spirally at the upper part, so that they may have elasticity enough to permit of the motion of the whole without forcing the joints.

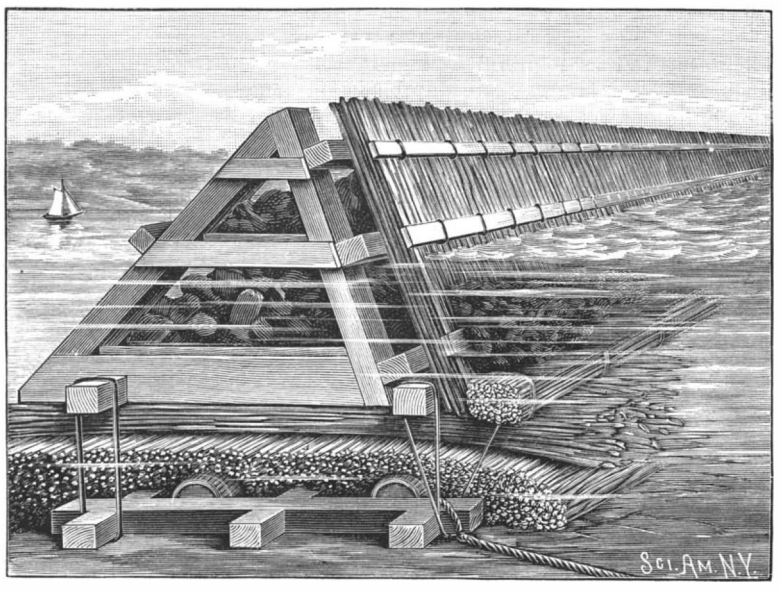
In the case under consideration, the oscillating motions reach an amplitude of $\frac{3}{10}$ inch, and nothing is more curious than to see the whole affair, whose weight exceeds 25 tons, displace itself rapidly without the least vibration being felt at the edge of the trench. The same process is applicable to the rails of railways upon metallic viaducts crossing cities, and to the engines of boats, etc.

The second method of isolation, applied to vehicles, consists in the use of a rubber support, which, placed between the axle and the spring of carriages, gives a complete and stable isolation, increases the ease of motion and the duration of service, diminishes the noise, and reduces the variations in the tractive stresses of the horses.

This rubber support serves to fix the spring firmly upon the axle, if it is a question of a vehicle, without interfering with the elasticity of the junction by too much tightening, a drawback connected with all the arrangements hitherto employed. This result is obtained by means of a mode of attachment which interposes (1) an isolating rubber tube between the coupling plate and axle; (2) of a foundation disk of rubber supporting the load; and (3) of a reaction disk which isolates the nut and lessens the rebounding. The compression between the metallic parts is effected without crushing the metallic joint.—*La Nature.*



ELASTIC SUSPENSION OF MACHINES.



WEEKE'S SYSTEM OF BUILDING DIKES.

WEEKE'S SYSTEM OF BUILDING DIKES.

The dike illustrated in the accompanying engraving is admirably adapted for use at places where the water is of considerable depth. It consists primarily of a floating frame made of wood, and which is provided with barrels or other suitable floats. This frame is anchored by lines or piles. The work of building up the dike is carried on upon this floating frame, and above water line, the structure being gradually submerged as the superincumbent weight increases. A thick layer of rails, brush, willows, poles, or other similar material is placed upon this frame, and one or more similar layers are placed upon this transversely. These layers are lashed to the frame by wires and clamp timbers. Upon this structure is mounted an inclined trestle or frame, as shown in the cut, of

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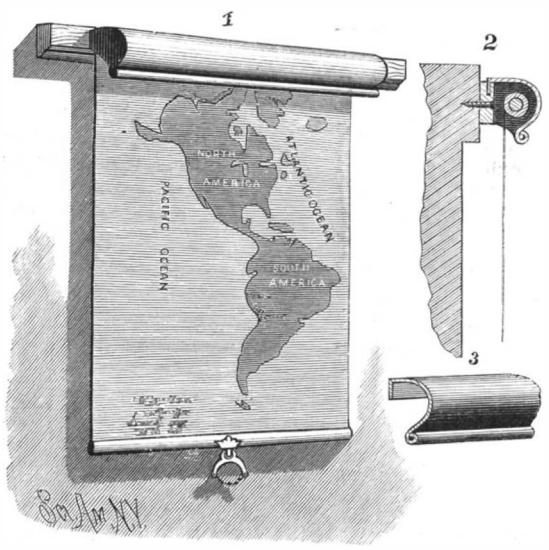
a height sufficient to bring it above high water mark. Layers of brush, willows, reeds, etc., are lashed vertically to the trestle by means of horizontal stringers bound to the frame of the trestle as shown. The trestle frame is then filled with stones and gradually sunk.

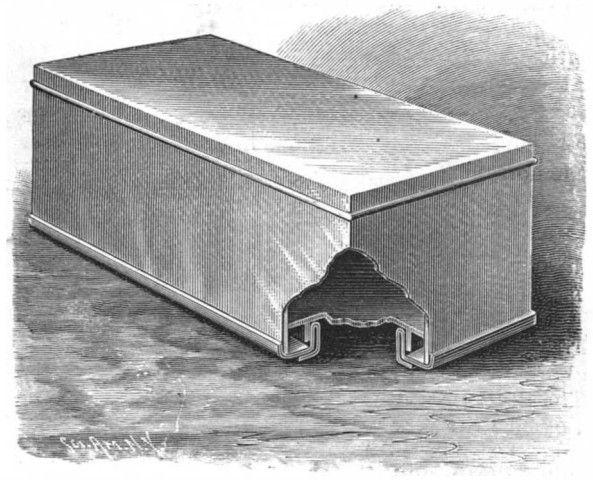


BULLARD'S EXHIBITOR FOR WINDOW SHADES, ETC.

The weight of the stones will be sufficient to retain the dike firmly in position. A bundle of reeds or willows is bound to the frame at the point of intersection of the vertical and horizontal layers of reeds to prevent the water from flowing between these layers, and a pile of stones from two to four feet high is piled upon this to keep it in place. This system has been patented by Mr. Henry C. Weeke, of St. Charles, Mo.

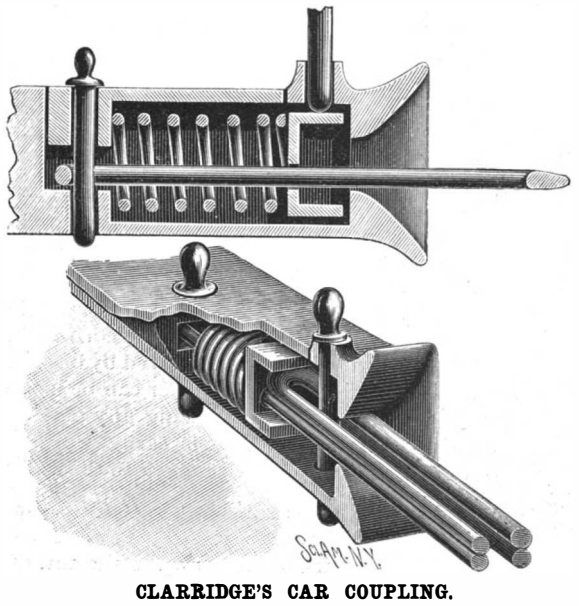
A BOX TO HOLD BRICKS OF ICE CREAM.

A box for containing bricks of ice cream, and which will admit of the cream being dislodged from the box with neatness and dispatch, is illustrated herewith, and has been patented by Mr. James Van Dyk, of No. 116 Bridge Street, Brooklyn, N. Y. The cover may be



VAN DYK'S ICE CREAM BOX.

of any approved construction, but the bottom is movable, of a form to fit snugly within the box, and has a downwardly extending flange a little distance from the edge. At the bottom of the body of the box is formed a flange adapted to constitute a seat for the movable bottom, and also a channel between the flange and the body of the box, the flanges being so formed and arranged that the one will fit snugly within the other. The body of the box is made gradually wider from the bottom upward, so that as the movable bottom is pressed up, acting as a follower to the cream, the latter need only to be started to loosen it and permit its ready removal. To retain the bottom within the box, and obviate the possibility of its misplacement or injury, retainers, not shown in the illustration, are secured to the inner surface of the body of the box, each formed of sheet tin or like sharp material, whose sharp edge will present but little resistance to the cream, and will not mar its appearance.



CLARRIDGE'S CAR COUPLING.

AN IMPROVED EXHIBITOR FOR SHADES, MAPS, ETC.

A readily attachable device, which will effectually conceal a shade when rolled up and shield it from light and dust, is illustrated herewith, and has been patented by Mr. Edwin A. Bullard, of Vassar, Mich. The fixtures of a spring curtain roller are secured upon the face of a strip of wood, a number of which strips may be arranged in succession over the shelving. In the upper edge of the strips is a groove, to receive and retain in position over the curtain fixtures and roller a protector, consisting of a piece of sheet metal or equivalent material, bent to form a semi-cylindrical body, as shown in Fig. 3, the manner of attachment being shown in the sectional view, Fig. 2. When a series of such covers are in position they will form a moulding as far as they extend. These exhibitors may also be used in connection with curtain fixtures of dwelling houses, the protector being put up the full width of the curtain, and the slats secured to the casing of a wide or narrow window.

AN IMPROVED CAR COUPLING.

An automatic car-coupling, employing ordinary coupling pins and links, with the drawbar of about the form of those already in use, is illustrated herewith, and has been patented by Mr. John Clarridge, Sr., of Libertyville, Iowa. The draw bar has the usual flaring mouth, but with the inner part reduced in size to form a guide for the link, the chamber for receiving which contains a spring. In the rear of the chamber are shoulders to act as an abutment for the spring, and in its mouth are shoulders to limit the motion of a follower pressed forward by the spring, this follower consisting of a plate bent twice at right angles, and having an oblong aperture to admit a link. At the rear of the chamber are vertical apertures for receiving a coupling pin to permanently retain a link in place in the drawbar, the follower then, when the coupling is ready to be connected with another coupling, being in the position indicated in the sectional view, and forming a support for a coupling pin, for which vertical apertures are provided in the forward part of the drawhead. The outer end of each link is beveled, so that when it approaches another link similarly supported it will not be liable to collide with it, but will slip past, either above or below it. When the cars approach each other, the parts being arranged as shown in the sectional view, the link carried by each drawbar enters the other drawbar and pushes back the follower against the pressure of the spring, allowing the outer pins supported by the followers to fall through the links thus introduced, and automatically effecting the coupling.

KANE'S CAR BRAKE.

Mr. George O. Kane, of No. 193 Thurbus Avenue, Providence, R. I., is the patentee of an improved brake for railroad cars in which the brake shoe is applied to the track instead of to the wheel of the car. By this method the wear upon the wheels from friction with the shoe and sliding on the track is avoided. The entire weight of the loaded car bearing upon the brake shoe brings the car and train to a sudden stop. Two pairs of oppositely arranged brake shoes are pivoted at one end to a depending frame on each side of the car, the other end of each shoe being connected with the lower extremity of a toggle joint. The upper arms of the toggle joints are pivoted to the car frames, while the joints are attached to opposite ends of the brake beams, so that when the brake beams are made to approach one another, the angle of the toggle joint is increased and the shoe is lowered on to the track. As may be seen by examining the cut, between the brake beams fixed upon an immovable frame is pivoted a brake lever, which is united with the brake beam by connecting rods, so that when the brake lever is turned by means of the brake rods, that connect the ends of the lever with the brake on the platform of the car, the two brake beams will be made to approach one another, straightening the toggle joints, and the brakes will be forthwith applied. The rods connecting the brake beam with the brake levers are provided with springs at their outer ends.

ANCEL'S STOVE PIPE AND TENT SUPPORT.

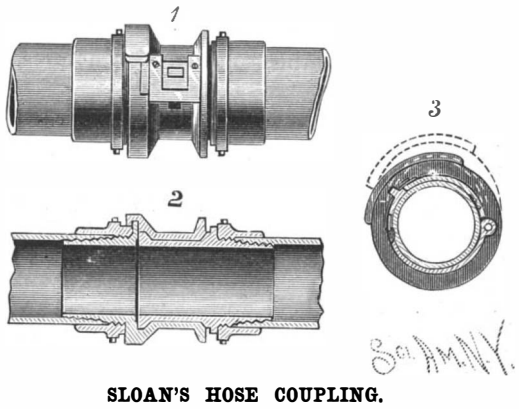
In the device illustrated in the accompanying engraving, the smoke pipe of the stove is used as the support of the tent. This device has been patented by Mr. John W. Ancel, of Fort Buford, Dakota. The stove pipe is made telescopic, the smaller sections at the top being made to slide inside of the sections under it. Each section at its extremities is provided with holes into which are inserted screw-threaded pins for locking the pipe in position. The stove may be of any desired type. The top section of the pipe has a sleeve provided with a flange from which is suspended the heavy ring which carries the tent proper. This sleeve is removable, and is likewise locked in position by means of a pin. A bell-like shield caps the whole to prevent rain or snow from entering the opening at the top of the tent. The sections of the pipe are made flanging at the bottom and are bent in at the top so as to make the joints tight-fitting. By this device the smoke is carried away and the tent is thoroughly ventilated, while the ordinary tent pole is done away with. When traveling, the pipe may be folded and packed

COMBINED STOVE PIPE AND TENT SUPPORT.

away into very small space, occupying no more room in fact than the largest pipe section.

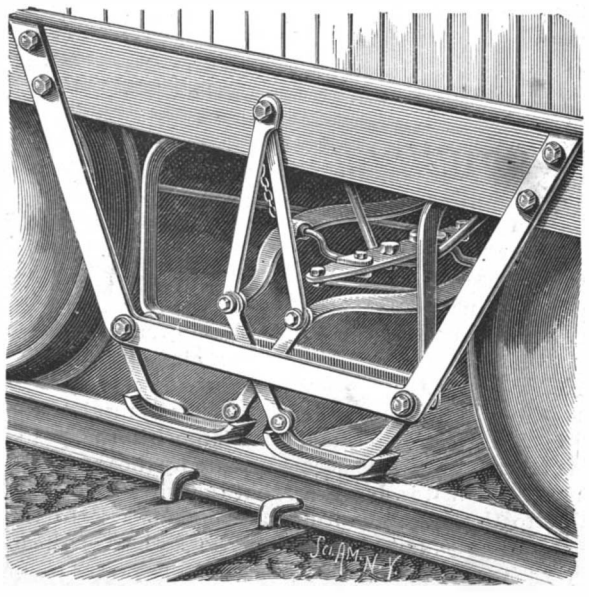
AN IMPROVED HOSE COUPLING.

The illustration herewith represents a hose coupling designed to be simple in construction and efficient in operation. It has been patented by Mr. James D. Sloan, of Rushville, Ind. Fig. 1 represents a side view and Fig. 2 a longitudinal section of the coupling engaging two pieces of hose, while Fig. 3 represents a cross section. Collars, internally screw-threaded, are engaged on the respective ends of the hose, each hose being then engaged to the corrugated ends of a coupling, each collar being shorter than the corrugated ends of the coupling, permitting the outer end of each corrugated part to expand on the inside of the hose, and cause the hose to expand over the outer edge of each collar. This feature, with the corrugations, forms a strong connection between the hose and coupling. The body of the



SLOAN'S HOSE COUPLING.

coupler has an end collar, a middle collar, with one part narrower than another, and external corrugations at one end, a part of the side at one end of the body being cut away, or provided with a large opening, to be closed by a hinge. When the hinge is closed, a yoke spring engages a lug on the body and locks the parts. When disengaged, a flat spring is exerted to open the hinge, the extent to which it may be opened being limited by a small lug, as shown in dotted lines in Fig. 3. When the hinge is open, the part corresponding with the pipe section, having two collars and threaded end, held in one end of the hose, may be engaged with the body or hinged part of the coupling. Then by closing the hinge and causing the yoke spring to engage with a lug on the body, the several parts of the coupling are firmly united.



IMPROVED CAR BRAKE.

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The Luster of Metals.

Dove was the first to attempt an investigation of the causes of metallic luster. He had examined, by the aid of a stereoscope, two images of a pyramid, one being colored blue and the other yellow, expecting to find a relief image of a green color. He was, however, astonished to find that the mixture of colors gave a reflection like that of a polished metallic surface. Having repeated the experiment, using a black and a white image, he obtained the metallic gray of lead and tin. Dove concluded that metallic luster is due to two reflections from superposed surfaces, and that the accommodation of the eye being different for each color, a perfect coincidence of the images of different colors was impossible. The luster of metals would thus be caused by a reflection from the actual surface and another from beneath the surface. This explanation attributes a considerable degree of transparence to the metals, more indeed than seems consistent with fact. Brücke offered another theory, according to which the color of light reflected from bodies not possessing the metallic luster should be independent of the local color—that is, the color of the reflecting body—while in the case of metals the color of the reflected light is that attributed to the substance, the incident light being white. Brücke also considered that a certain intensity of reflection was a necessary condition for metallic luster, this intensity resulting from the opacity of the metals, and he mentions the phenomenon of total reflection as producing a perfect imitation of metallic luster. The theories of Dove and Brücke represent opposing views of the transparency of the metals; the one considers them as opaque, the other as transparent. Herr W. Spring (*Bul. Soc. Chim.*, 50, 219) endeavors to reconcile these views by a study of the nature of the surfaces of the solids he has obtained during his experiments on the compression of solids within polished steel cylinders. He finds that substances which in the form of powder are opaque produce solids that have a metallic luster, whatever the nature of the substance, while such substances as yield powders more or less transparent formed cylinders having vitreous surfaces, looking as if varnished.

The Deadly Wire.

Recently an electric wire carrying a powerful current of the subtile and mysterious force fell across Bourbon Street, near the theater of the French opera, at a time when many people were passing. It happened that a mule which was drawing a street car came in connection with this wire, and was at once stricken down by the deadly electricity and killed on the spot. The unfortunate mule was in some sense a sacrifice to save the lives of men and women, some of whom, but for the warning given, might, in all probability, have stumbled upon the fatal wire with a like result.

The electric wire has introduced a new element of menace to human life and to the security of property that seems scarcely to have come into the purview of law makers, who are charged with legislation for the protection of life and property. The industrial uses to which electricity is being put are constantly increasing, and scarcely a week passes without additional wires being erected to conduct the force which has been wrongly termed a fluid. Every such wire is a new danger—an additional thread from which to suspend a sword of Damocles over the heads of the people.

As to laws for their protection, there seems to be none. True, a general law exists which would make an electric light company liable for damage caused by wrongful or criminal negligence on their part, but so little is known of electricity as a practical industrial force motor, save by a few experts, that it would be extremely difficult in court, in a claim for damage, to establish undue or wrongful negligence on the part of an electrical company. Let us inquire a little. The wires are suspended from wooden poles over the streets of the city. Are the wires securely placed? What constitutes security in the premises? The wooden pole readily rots; it may be broken by the enormous weight of the wires it carries, and such a result is extremely likely when a great network of wires so suspended is violently and forcibly vibrated by the wind. There appear to be no restrictions as to the number of wires strung upon a pole. Almost every day additions are made to those already there. Then as to the methods of fastening the wires to the poles—the main thing considered is to insulate the wire from electrical communication with the posts. The fastenings may be deemed secure by those who use them. The fact is, however, that the wires frequently fall into the streets, with fatal consequences to the people at large, not to the corporations who own them. They may suffer temporary delay of business.—*N. O. Picayune.*

AN IMPROVED FIRE ESCAPE.

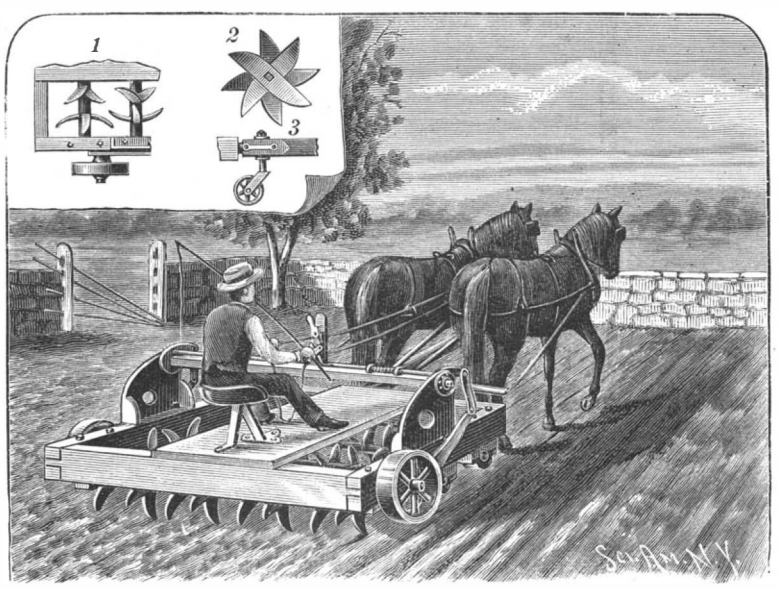
A simple form of fire escape, which can be readily made available from any window of a house, and with which the speed of descent can be readily regulated by the person descending, is illustrated herewith, and has been patented by Mr. Joseph Abbott, of Rumney, N. H. It is made with two forked arms, pivoted at their forked ends, and each having a snap hook at its free end, the fork of one arm extending within that of the other. Around the pivotal bolt, as shown in the small views, a rope may be wound one or more times, and is

ABBOTT'S FIRE ESCAPE.

thence extended down between jaws made by the arms, which are drawn closely upon it by a spiral spring connecting the two arms. The upper end of the rope has a hook by which it is to be secured to a window sill or other part of the building, while the lower end is dropped to the ground. A hanger, or strap, in which the person descending is to be seated, has rings at its ends, to be connected with the arms by hitching upon the snap hooks, both ends of the strap passing through a metallic adjusting ring, before being connected with the arms, the speed of the descent being then regulated by moving the adjusting rings up or down, whereby greater or less brake pressure is put upon the rope. An extra strap is supplied to be passed under the arms, when desired, and attached similarly to the snap hook. The device is furnished to weigh less than three pounds, and only 10½ inches in length.

AN IMPROVED SOD CUTTER AND HARROW.

An apparatus for effectively breaking up sod or ground, and wherein the cutters may be regulated to any desired depth, or the apparatus may be carried from field to field without the cutters touching the ground, is illustrated herewith, and has been patented by Mr. Abraham Madson, of Galesville, Wis. Within



MADSON'S SOD CUTTER AND PULVERIZING HARROW.

aligning hangers attached to the under face of the frame side pieces are journaled transverse shafts, polygonal a greater portion of their length, upon which are fixed the knives or cutters, Fig. 2 being a transverse section through one of the cutter shafts, while Fig. 1 is a partial plan view at the ends of two of the cutter shafts. Each set of cutters consists of two knives mounted in such manner that one knife will be at right angles to the other, forming a cross. The several shafts carrying the cutters are so journaled that the curved surface of the blades mounted upon one shaft will be contiguous to the surface of the equivalent blade of the next shaft, whereby the entire surface of the ground traversed by the apparatus will be pulverized. A lever is pivoted centrally to each side bar of the frame, on the lower end of which the drive wheels of the apparatus are studded, the other ends of the levers projecting diagonally upward parallel with the outer face of brackets attached to the upper surface of the side bars. In the brackets a transverse rock shaft is journaled, having near each end an arm pivotally connected by a link with the upper extremities of the levers on which the drive wheels are studded. A standard is secured centrally on this rock shaft, with a hand lever fulcrumed in its top, whereby the lever carrying the operating wheels may be raised or lowered, to regulate the depth of cut or lift the cutters from the ground. The rock shaft is held in the position desired by means of rods passing through apertures in the arms at the ends of the shaft, each rod also passing through one of a series of apertures in the bracket around the bearings of the rock shaft, these rods being automatically projected by a spring on each. The shaft hinged to the forward end of the frame has an adjustably secured caster wheel.

Miscellaneous Notes.

The Eiffel Tower in Paris had reached a height of 761 feet on January 9, 1889—the highest structure upon the globe.

Standard Time.—All the railroads in the United States and Canada, without exception, now use the standard time of one of the four sections—eastern, central, mountain, or Pacific. Cities and towns have very generally conformed to railroad time of their respective sections. Out of 288 cities of over 10,000 inhabitants, less than 25 still retain local time.

Force of the Wind.—The high wind of Saturday night, January 5, blew the car cable out of the sheaves on the Brooklyn bridge, stopping travel for a short time.

Work of Flowing Artesian Wells.—At the Ponce de Leon Hotel, St. Augustine, Florida, an artesian well furnishes power through a turbine and dynamo for lighting the building and grounds by electricity.

At Yankton, Dakota, a flowing well drives the dynamos of an electric lighting company, the water flowing to a reservoir, from which a turbine is actuated.

African Railways.—It is proposed, by a new company just formed in Brussels, to build a railroad to connect the head of navigation on the lower Congo with Stanley Pool, thus opening up a line of about 7,000 miles in the interior of Africa to trade and commerce.

Trade Schools.—By the munificent gift of Mr. I. V. Williamson of stocks of a market value of $2,250,000, a "Free School of Mechanical Trades" is to be erected and organized near Philadelphia.

The Pratt Institute of Trades and Art, Brooklyn, N. Y., opened the year with 1,000 pupils.

Cloth and Paper of Corn Husks.

One of the best utilized waste products in Austria, resulting in the manufacture of large quantities of paper and cloth, are corn husks. The *Evening Telegram* condenses from a foreign publication the process for separating the fiber. The husks are boiled with an alkali in tubular boilers, as a result of which the fibers of the husks are found at the bottom of the boiler in a spongy condition, filled with a glutinous substance, and which proves to be a perfect dough of corn meal, containing in a concentrated form all the pabulum originally contained in the husk. The glutinous matter is pressed out from the fibers by hydraulic apparatus, leaving the fiber in the shape of a mass or chain of longitudinal threads interspersed with a dense mass of short fiber. The linen made from the long fibers furnishes a very good substitute for the coarser kinds of flax and hemp, and is superior to jute, gunny cloth, coir, and the like.

The paper, for which mostly the short fibers are used—the long fibers constituting the material for spinning—is stronger than papers of the same weight made from linen or cotton rags, its hardness and firmness of grain exceeding that of the best dipped English drawing papers, being especially adapted for pencil drawing, stenographic writing, and water colors. Its durability exceeds, it is claimed, that of paper made from any other material, and the corn husk parchment is not at exposed points destroyed by insects. If the gluten is left in the pulp, the paper can be made extremely transparent without sacrificing any portion of its strength. Again, the fiber is easily worked, either alone or in combination with rags, into the finest writing or printing papers. It also readily takes any tint or color, and can be worked almost to as much advantage into stout wrapping papers of superior quality as into fine note and envelope papers.

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DECISIONS RELATING TO PATENTS AND TRADE MARKS.

Supreme Court of the United States.

ANDERSON *vs.* MILLER *et al.*

Letters patent No. 265,733, granted October 10, 1882, to Robert H. Anderson, for an improvement in drawers, not infringed by an article manufactured by the appellees for more than two years prior to the appellant's application for a patent.

Appeal from the circuit court of the United States for the Eastern District of Virginia.

Mr. Justice Lamar delivered the opinion of the court.

The alleged infringement consisted in appellees placing on drawers manufactured by them a patch extending down the front and lapping the seam of the crotch by at least half an inch, which process of re-enforcing the garment, it was alleged, was the invention of the appellant.

The averments of the answer are: That drawers, as re-enforced as described in letters patent of plaintiff, had been made and in public use and on sale by sundry and divers persons for many years prior to plaintiff's application; that they, the defendants: Have been manufacturing one particular kind, and only one particular kind, of re-enforced drawers for more than five years hitherto continuously, a specimen of which drawers, manufactured by them, is filed as "Exhibit A," etc., and that these are the only kind of re-enforced drawers that have been manufactured by them or either of them during the last five years.

The circuit court dismissed the bill, and an appeal from that decree of dismissal brings the case here.

The decree of the circuit court is affirmed.

Supreme Court—State of New York.

TRADE MARK.

MUNRO *vs.* BEADLE *et al.*

Ingraham, J.:

The only act of the defendants complained of by the plaintiff is the introduction of the word "Sleuth" in the title of certain stories published by the defendants. There was no attempt on the trial to show that the defendants had used any symbol or design invented by the plaintiff to designate his series, and unless the plaintiff can establish that he has in some way acquired the exclusive right to use the word "Sleuth" in connection with stories of detectives, no right of plaintiff's has been infringed.

The word "Sleuth" has a well defined meaning, and is defined by Webster to mean "the track of man or beast as followed by the scent." It is used in connection with a hound to indicate that a hound follows the track of a human being or animal, and as applied to man would have the same meaning.

The adoption by the plaintiff of the name of "Old Sleuth" to designate the series of books published by him could hardly be said to give to the plaintiff the exclusive right to use the word "Sleuth" in all future publications of every character, so that the rest of the world must invent a new word to express that meaning. That would be the logical effect of sustaining the position taken by the plaintiff in this case.

The titles adopted by the defendants in the publication of their books would be perfectly intelligible to any one having no knowledge of the use to which the word had been applied by the plaintiff, and, assuming that the plaintiff had acquired a trade mark in the words used by him to designate his publications, nothing proved in this case would show that the defendants have violated any rights that they have acquired. The plaintiff has therefore failed to show any cause of action against the defendants, and the complaint must be dismissed, with costs.

A Flowing Well in Iowa.

A Waterloo, Ia., dispatch to the Chicago *Tribune* says: "The flowing well near Tripoli, Bremer County, is attracting considerable attention, as it appears to be another Belle Plaine gusher on a slightly smaller scale. It is located on the farm of J. J. Cooke, about three miles east of Tripoli, and only a short distance from the Wapsie River. The well was drilled down through the rock and sand about 135 feet. Water was struck several times, and when a depth of 129 feet was reached the water filled the well to within eight feet of the surface. After drilling two hours longer the water began to overflow. Work was stopped and a six-inch casing put in. At three o'clock the next morning, December 30, Mr. Cooke was awakened by a roaring noise, and, on going to the well, he found the water spouting about three feet above the top of the tubing and throwing out blue sand and clay. After throwing out about three wagon loads of this debris the water became clearer, but its force increased until it rose fully six feet above the top of the casing, besides opening the seams in the casing at several places. Four joints of stovepipe were then put on the casing, and the water flowed in a torrent from the top of this improvised tube fully twelve feet from the ground. "Since then the well seems to have lost some of its force, but it still sends out a stream which, if confined, would, it is estimated, throw a three-inch stream fifty feet high. It is the intention to replace the casing in the well with a six-inch gas pipe, and in that way it is expected that the flow of water can be controlled.

The International Congress of Photographers at Paris.

By a ministerial order, dated August 2, 1887, a congress and series of conferences were instituted to be held in Paris during the Universal Exhibition of 1889. By another resolution, dated July 16, 1888, of the Minister of Commerce and Industry, Commissioner-General of the Exhibition of 1889, a Committee of Organization of the International Photographic Congress was nominated;

M. Andra, member of the Administrative Council of the French Photographic Society; M. Bardy, Vice-President of the French Photographic Society, and Director of the Laboratories for *Contributions Indirectes;* M. Edmond Becquerel, member of the Academy of Sciences, the chief discoverer and pioneer in relation to photography in natural colors; M. Bordet, the manager of photographic conferences at the school of *Ponts et Chaussees;* M. Alfred Chardon, member of Council of the French Photographic Society; M. Cornu, member of *l'Institut;* M. Davanne, Vice-President of the French Photographic Society; M. Gauthier-Villars, member of Council of the French Photographic Society; M. Gobert, member of Council of the French Photographic Society; M. Guilleminot, manufacturer of chemical products; M. Haincque de St. Serroch, member of Council of the French Photographic Society; MM. Paul and Prosper Henry, of the Paris Observatory, well known for their achievements in stellar photography; Dr. Janssen, member of *l'Institut* and Director of the Astronomical Observatory at Meudon; M. Levy, photographer; M. Albert Londe, the chief photographic worker at the Salpetriere, in Dr. Charcot's department; M. Adolphe Martin, physicist, member of the Council of the French Photographic Society; M. Pector, member of Council of French Photographic Society; M. Peligot, member of *l'Institut*, President of the French Photographic Society; M. Perrot de Chaumaux, General Secretary of the French Photographic Society; M. Roger, member of the Council of the same society; Colonel Sebert; M. De Villecholles, member of Council of the French Photographic Society; M. Wolff, astronomer, member of *l'Institut.*

At the first meeting of the Committee of Organization, Dr. Janssen was elected president; Messrs. Wolff and Davanne, vice-presidents; and M. Pector, secretary and treasurer. It was also resolved to elect in foreign countries and in France some honorary members of the congress, who are requested to promote its interests, to group its supporters, and to study in advance the subjects to come before the congress, as well as to suggest others.

The list of those photographers in foreign countries and in France who will be invited to become honorary members is not yet completed; but among those who will receive invitations are Mr. James Glaisher, Captain Abney, Mr. J. R. Dallmeyer, Mr. Ross, Mr. John Spiller, Mr. Tennant, Mr. Common, and Dr. William Huggins.

The list of subjects proposed to be discussed by the congress is not yet completed, but will include the following:

1. Relative units of light. Photometry.
2. Lenses. Best mode of determining their focal lengths. Proportions between the apertures of diaphragms and the foci of lenses.
3. Unity in the expression of formulæ of solutions used in photography.
4. Unity in the dimensions of lens flanges.
5. Unity in the names of photographic processes.
6. Measures to be proposed to various governments to facilitate the passage through custom houses of photographic surfaces sensitive to light.
7. The application to photographs of the same copyright privileges as granted to works of art.

The meetings of the congress will probably take place during some period between July 15 and August 15, 1889. This time, however inconvenient to the Parisians, who might like to be at the seaside during the vacation, is likely to be the best for foreigners who visit the exhibition in the holiday season.

Any photographer who presents his card will be welcomed at the meetings of the congress, and to take part in the discussions. Those who intend to read papers will probably have to send them in in advance, that due order in the proceedings and subjects may be arranged beforehand.

What has herein been stated will give a general idea as to the nature of the congress and its scope, but are not cast iron decisions; they are liable for some little time yet to additions and modifications. All persons who have the interests of photography at heart cannot, I think, do better than to make their suggestions at once to M. Davanne, Vice-President of the French Photographic Society, Rue des Petits Champs, Paris.

It will be noticed that the congress is connected with and recognized by the authorities of the Paris Exhibition.—*Correspondence in Br. Jour. of Photo.*

Modern Fortifications.

Under this title the *Esercito Italiano* quotes an interesting article of the *France Militaire* on the modifications rendered necessary in the plan and construction of fortresses and fortified places for the future by the overwhelming power of modern explosives. A repetition of experiments on a large scale tends to show that iron and a very solid sort of concrete, rich in cement, are the only materials capable of offering a prolonged resistance to the action of modern artillery. Sand may be usefully employed under certain circumstances, but the uselessness of earth ramparts has been clearly demonstrated. In future, therefore, the main feature of a fort is most likely to be a round ironclad tower emerging from a glacis of concrete and furnished with heavy ordnance to reach the assailant at long ranges, and with lighter artillery for flank firing and for firing at shorter ranges. Forty or fifty machinists and artillerymen will probably compose the whole garrison of these forts. But the defense will, moreover, consist in a body of movable troops and artillery, to be conveyed to any point in the circumference, under the shelter of natural or artificial cover, by a narrow gauge railway. According to this system of defense, the assailants will no longer enjoy alone the advantage of concentric fire. Important experiments of this kind have been witnessed by the French Minister of War at the fort of Lucey, near Toul.

The *Esercito Italiano* states that three new batteries are in course of construction at Nice, viz., at Rimiez, the Corniche, and the Lanterne. The last of these three has for its object to obstruct the passage of the Vare. The erection of the three batteries has already been commenced by three different contractors. The French government is also erecting a fort on Mont Grois, where the trees have been felled over the whole area. The works are to be carried on with the greatest possible alacrity.

The *Rousskii Invalid* gives a list of German fortified places furnished with ironclad batteries or forts, namely, two towers at the fort of Vogelsang, at Cologne; one at Fort Manstein, Metz; at Fort Kamecke, several small towers for cannon of 15 centimeters; at Bremerhaven, facing the sea, nine towers for cannon of 28 centimeters, two for cannon of 15 centimeters, and a battery for nine 21 centimeter cannon; two towers at Ham, for the defense of the bridge on the Rhine; two towers at Ingolstadt. The German government has also ordered sixty ironclad towers for heavy cannon and mortars for the fortifications of Metz and Strassburg. They are to be constructed at the Gruson factory at Buckau-Magdeburg. Besides these a large number of towers of smaller dimensions are in course of construction, and will be supplied eventually with Maxim guns. The greatest activity prevails at the above mentioned works, showing the great importance attached to ironclad fortifications by the German government.

The New York Fire Department.

Following is a summary of the operations of the New York Fire Department for the year just closed, as reported by the Fire Commissioners:

OPERATIONS OF THE FIRE DEPARTMENT—1888.

FIRE EXTINGUISHING FORCE.

	Number.
Officers and men	1,019
Engine companies (including two fire boats)	55
Hook and ladder companies	19
Steam fire engines	87
Fire boats	2
Hook and ladder trucks	35
Horses	294

FIRE STATISTICS.

Total number of fires	3,202
Fires confined to point of starting	2,877
Fires confined to building	201
Fires extended to other buildings	48
Fires extinguished without engine stream	2,165
Fires extinguished with one engine stream	686
Fires extinguished with more than one engine stream	351
Fires resulting in nominal damage only	1,107
Fires—Building not damaged	520
Fires—Building slightly damaged	1,025
Fires—Building considerably damaged	106
Fires—Building destroyed	18

	Loss.	Insurance.
On structures	$1,566,401	$23,280,193
On contents	3,923,929	17,988,363
Total	$5,490,330	$41,268,556

	1887.	1888.
Average loss per fire	$1,917.28	$1,714.66

Number of fire alarms, 3,406.

Tramways in Damascus.

An imperial firman has, it is reported, been granted for the construction of a line of tramways in Damascus. Nor is this concession to western civilization the only sign that the far-famed city of Damascus is on the high road to becoming modernized. Gas also is to be introduced into the city, and the inhabitants are eagerly awaiting the promised innovations, which will, they believe, not only add to their own comfort, but will materially increase the value of property within the city boundaries. The latest estimate of the population of Damascus places it at 150,000.

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THE MAXIM AUTOMATIC MACHINE GUN.

BY HUDSON MAXIM.

The Maxim gun has already been described in these pages. The object of the present paper is to describe its operation more fully and illustrate in greater detail the various parts of this gun, so that its principle of action may be thoroughly understood. Since its introduction, this gun has met with marked success, and has been adopted by nearly all the European powers, including England, France, Germany, Italy, Switzerland, Austria, and Russia. The gun is soon to be tested at the proving grounds at Annapolis, with a view to procuring its adoption by the United States government. The speed of fire of the rifle caliber gun using the American cartridge is very high, being 700 per minute. The one pounder will discharge 400 shots per minute. A six pounder adapted to fire shrapnel and grape canister will discharge at the rate of 150 per minute. This description relates only to the Maxim mitrailleuse or machine gun of rifle caliber; but the employment of automatic action, though modified, is essentially the same in the Maxim system of guns of larger calibers. The Maxim automatic mitrailleuse is so constructed that, on firing a single shot to start the gun, the force of the recoil is utilized for extracting the empty cartridge case and for effecting the various operations necessary in reloading and again firing the arm, or preparing it for the next discharge; so that, after the gun has been started by once pulling the trigger, all these operations are performed automatically, and the gun continues firing with great rapidity, so long as the trigger is held in a pulled position and the supply of cartridges lasts.

The operation of the gun is, briefly, as follows:

In starting the gun, the breech mechanism is operated by hand to insert the first cartridge in the barrel, and the trigger is then pulled by hand to fire the first shot. The backward force of the explosion is received by the breech block, which recoils and carries the barrel backward with it. In the recoil, the breech is opened, the empty cartridge case is extracted, the hammer is cocked, and another cartridge is brought into position to be thrust into the barrel. The energy of the recoil not consumed in performing the above operations is stored up in a spiral spring, which, by its reaction, effects the return of the barrel to the firing position, thrusts the live cartridge into the barrel, and closes the breech. The moment the breech is closed the gun is fired automatically, the gunner having nothing to do but to point or aim the gun and hold the trigger in a pulled position.

The gun practically consists of two portions—a recoiling and a non-recoiling portion. The recoiling portion embraces the barrel, the lock, the crank, the breech block, and an inner frame with guides and bearings on which the said mechanism operates.

The recoiling portion is, in reality, the gun proper. The outer, or non-recoiling, portion may be justly considered the carriage on which the gun operates. Reference is to be had to the accompanying drawings forming a part of this description, in which similar figures of reference indicate corresponding parts in all the cuts.

Fig. I. represents the gun in action, with spare boxes of ammunition placed on the mounting, and shows the empty cases being thrown out in front.

Fig. II. is a view of the outside or non-recoiling portion of the gun, which is mounted on trunnions, and has attached traversing, elevating, and depressing gear, and is provided with handles and sights for aiming and a trigger for firing.

Fig. III. is a longitudinal central section of the gun, with all the parts in the positions of "ready" for firing, on the trigger being pulled.

Fig. IV. is a plan view of the gun with the cover, 32, seen in Fig. III, removed, and other parts in section to display the mechanism.

Fig. V. is a perspective view of the feed box and part of its mechanism for feeding the cartridges to the gun.

Fig. VI. is a view of the recoiling portion of the gun, tilted over so that the breech mechanism may be seen in perspective from the bottom. The outer or non-recoiling portion constituting the gun frame is not shown, and the parts are seen in the positions which they occupy when the breech block is at the rear end of its stroke or movement.

Fig. VII. is a view of the portion termed the bolt. It is shown tilted over, and its parts are seen in perspective and from the front and left hand lower corner, displaying the mechanism which constitutes, at once, the

Fig. I.—MAXIM MITRAILLEUSE IN ACTION.

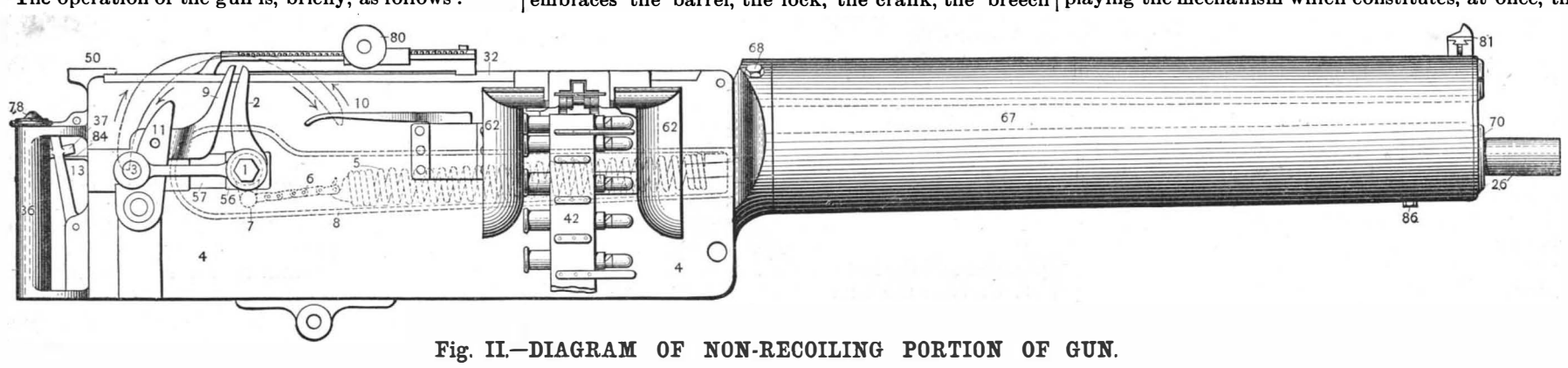

Fig. II.—DIAGRAM OF NON-RECOILING PORTION OF GUN.

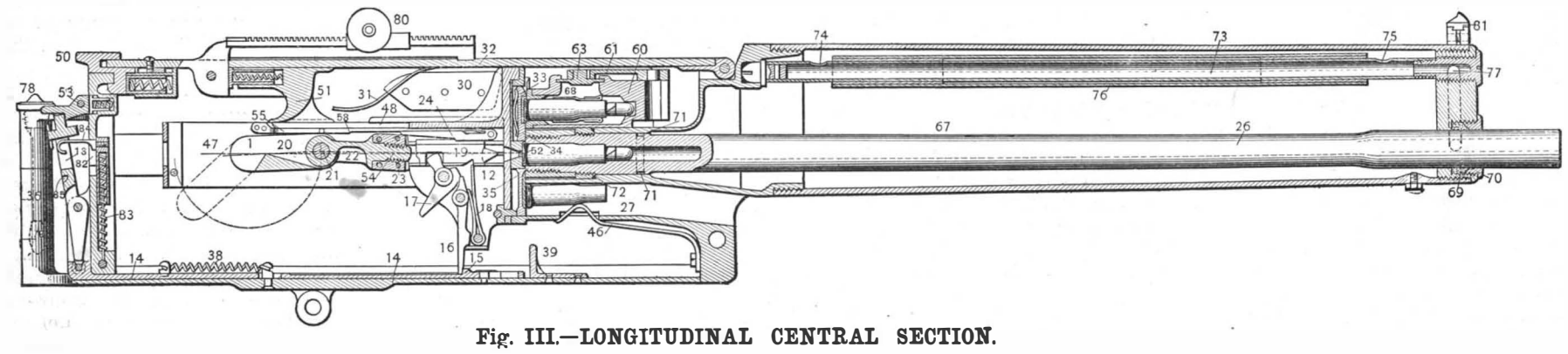

Fig. III.—LONGITUDINAL CENTRAL SECTION.

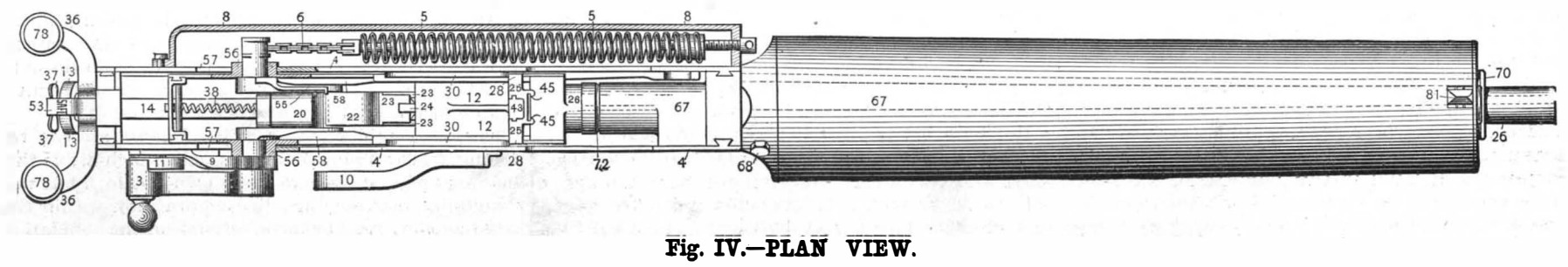

Fig. IV.—PLAN VIEW.

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lock, the breech block, and the cartridge carrier and extractor. It will be seen from this figure that in the handling of the loaded cartridge and the extraction of the empty case, the cartridge case is firmly seized at both sides of its head, no spring extractor being used. Very nearly all the machinery in the gun is contained in this one piece or bolt, which is quite small, and may be carried in a soldier's pocket. As this bolt is the only part of the gun which stands in any danger of breaking or becoming disarranged, it will be seen that such machinery of the gun is practically in duplicate, as each gun is provided with two bolts, one of which may be removed from the gun and may be replaced by the other in about five seconds.

All the parts shown in full lines in Fig. II. remain stationary when firing, with the exception of the outside crank arm or elbow lever, 2, 3, which is fixed to the crank wrist or shaft and forms a part of the recoiling portion, or gun proper, which is mounted inside of the gun frame, 4, in such a manner that when fired the recoil moves it back about one inch.

On the left hand and outside of the gun, or at the side opposite the crank, 2, 3, there is attached to the crank shaft, 1, a spiral spring, 5, by means of a chain, 6, and a small fusee, 7, as shown in dotted lines.

In Fig. IV. the spring box, 8, which contains the spiral spring, 5, is shown with the top removed, displaying the said spring with its chain connection to the crank shaft, 1.

When the gun is fired, the arm or cam, 2, of the crank 2, 3, which belongs to the recoiling portion, is brought in violent contact with a stationary point of resistance, 9, fixed to the gun frame, 4, the effect of which is to forcibly turn the crank shaft, 1, and cause the crank handle or arm, 3, to strike a buffer spring, 10, held outside the gun frame, so that, when the crank handle, 3, is resting on the buffer, 10, the spiral spring, 5, is not only extended one inch by the recoil, but the winding of the chain on the fusee causes a still further elongation.

Thus when the crank handle, 3, has been brought to a state of rest on the buffer, 10, the action of the spiral spring is first to pull the barrel and the whole recoiling portion back into firing position, and then to turn the crank to restore the bolt to firing position. As the crank handle is brought back to this position it strikes the dead stop, 11, which is pivoted to the gun frame and rocks on its pivot to receive the blow in such a manner as to prevent all rebounding.

In the longitudinal central section, Fig. III., all the parts are in the positions of "ready" for firing on pulling the trigger. The lock employed is very similar to that used in the old fashioned single barrel pistol, namely, a firing pin, a main spring, a hammer, and a sear. All these parts are mounted in the lock or bolt, 12.

When the upright trigger, 13, placed between the vertical handles, 36, is pressed, the rod, 14, is drawn backward and its projection, 15, engages the lower end of the sear, 16, thus releasing the hammer, 17, and the main spring, 18, then throws the firing pin, 19, violently forward to strike the primer and explode the cartridge. A spring, 38, returns the trigger and trigger rod to the cocked or freed position on removing the pressure.

All the operations of the breech mechanism are effected by the reciprocating movements of the outside crank, 2, 3.

The gun crank has an arm, 20, which is inside the gun frame, 4, and stands at right angles to the outside crank arm, 2. To this arm, 20, is pivotally attached the rear end of a connecting rod, 22, 23, the part, 23, of which straddles and is pivoted to the breech block, 12. Therefore, when the outside crank is turned forward, the inner crank arm, 20, is thrown downward and backward, as shown in dotted lines, Fig. III. The part, 23, of the connecting rod is thus brought in contact with the tail of the hammer, 17, pressing it down, drawing back the firing pin, and compressing the mainspring until the sear, 16, engages a notch in the hammer and a safety sear, 24, engages a notch in the firing pin. At the same time the breech block is withdrawn from the barrel, the empty cartridge case is extracted, a fresh cartridge is drawn from the belt, the carrier, 25, is lowered, and the live cartridge is brought in line with the barrel, 26, and the empty case in line with the discharge pipe, 27.

Projections, 28, on the carrier, 25, during the recoil and the opening of the breech, slide on cams, 30, on the frame, 4, whereby the carrier is held up until the empty case is extracted and a fresh cartridge is drawn from the belt. The lowering of the carrier is then effected by gravity assisted by a spring, 31, attached to the inside of the cover, 32, of the frame, 4. The carrier is guided and held steadily in its forward movements by the projections, 28, which slide in contact with the under surfaces of the cams, 30, until the breech block is home. The carrier, 25, has spring catches, 33, 34, and 35, which with its grooved side flanges hold the live cartridge and the empty case in their proper places in the carrier, as is well shown in the Fig. VII.

Cams, 40, in the closing of the breech, act on other

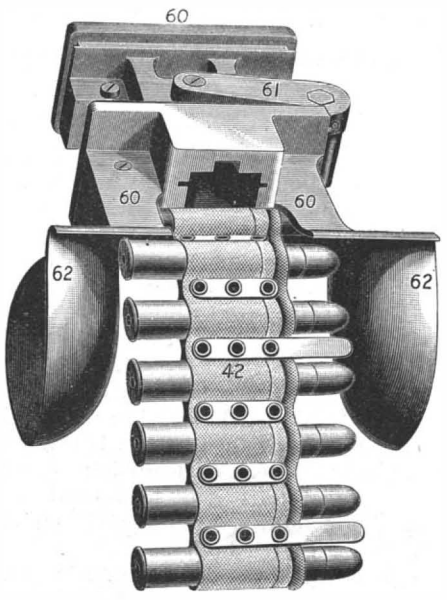

Fig. V.—FEED BOX.

cams on a lever, 41, to lift the carrier, 25. As the carrier rises, the spring, catch 33, yields and passes over the head of the loaded cartridge, in a belt, 42; the spring catch, 34, also passes over the head of the cartridge in the barrel, and the spring catch, 35, passes over the head of the empty cartridge case in the tube, 27, the carrier freeing itself from the empty case and at the same time taking firm hold of the fresh cartridge in the belt.

Grooves, 45, in this carrier, 25, are made to fit the flanged head of the cartridge, so that when the carrier rises, the cartridge is seized at both sides of the head, and while thus firmly held, the cartridge is extracted from the belt, performs its backward and forward movement with the breech block, and enters the barrel of the gun with unerring accuracy; its empty case is extracted therefrom, and it again retreats and advances with the breech block to be delivered into the discharge pipe, 27, where it is held by a spring, 46, until thrust out by the succeeding empty case.

The firing pin, 19, slides between guides in the breech block, and can strike the cartridge only through a hole, 52, in the carrier, 25; therefore, it can fire the gun only when the carrier is at the top of its stroke and the breech is closed, as shown in Figs. III, IV. The safety sear, 24, also secures the gun against firing until the breech is closed, by which action in the rising of the connecting rod, 22, 23, the sear is lifted, thereby releasing the firing pin. There is also a small safety catch, 53, which may be dropped down when done firing, and thus secure the trigger against being pulled until the catch is again lifted and thrown back by hand for that purpose.

In the continuous working of the gun, the empty cases are thrust one after another into the tube, 27, and are ejected therefrom with considerable force by the impact received from each succeeding case as it enters the tube.

The two parts, 22, 23, of the connecting rod are joined by means of an interrupted screw, 54, whereby after the bolt is lifted out of its guides it may be given a quarter turn and removed from the gun, inspected, and returned, or replaced by a new bolt, all in a few seconds. There is a small spring catch, 55, attached to the inner side of the recoiling frame, 47, which, when the part, 22, of the connecting rod is raised to remove the bolt, holds said part in place for more convenient reattachment of the bolt.

The crank shaft, 1, is supported in bearings, 56, which are formed on the inner recoiling frame, 47, and extend through slots, 57, in the outer gun frame, 4, these slots being of sufficient length to permit the required recoil of the frame, 47, and its connected mechanism.

When the breech is closed the crank arm, 20, is slightly above its forward dead center, and bears against stops, 58, on the recoiling frame, 47. Therefore, during the period of explosion, the breech block is firmly locked to the barrel and supported against the force of the explosion, so that the barrel, the crank, and the frame, 47, or the whole recoiling portion of the gun, will recede together until the crank arm, 2, strikes the point of resistance, 9, as above described, which throws the crank forward, opening the breech at first slowly, and then more rapidly as the recoil advances. Thus the empty cartridge case is started from the barrel of the gun, at first very slowly, as is in like manner the live cartridge from the belt. By far the larger portion of the time between discharges is consumed in the opening of the breech, so that ample time is allowed for the pressure of gases to escape from the barrel before the breech block is withdrawn from it.

The feeding of the cartridges into the gun is accomplished in the following manner: The cartridges are placed in the belt, 42, formed of two pieces of tape fastened together by eyelets and brass strips. The belt is made thick at the edge next the bullets by being folded over a cord, as shown, so that the cartridges may lie even in their magazines, while every fourth brass strip is made to project beyond the bullet edge of the belt a distance equal to that of the bullets, thus rigidly maintaining in the magazine the exact position of the cartridges in the belt.

The box or magazine which contains the belt, 42, filled with cartridges is placed in or on the mounting, and one end of the belt is passed through the feed box. Spare boxes of ammunition may be placed and transported on the mounting. The lever, 61, shown at the top of Fig. V., is operated in such a manner by the reciprocating action of the barrel that the cartridges are drawn into position one by one. The curved guide pieces, 62, keep the belt of cartridges in the proper position as it enters the feed box.

The gun frame, 4, has firmly attached thereto a cooling chamber or water jacket, 67, through which the barrel, 26, is arranged to slide longitudinally. The water jacket holds when full about 2½ quarts, and is filled through a hole at its rear end, which is closed by plug, 68. Water tight joints are secured about the barrel in the following manner: At the forward end of the barrel there is a stuffing box with packing, 69, and a gland, 70, which screws in and tightly compresses the packing around the barrel. At the rearward end of the barrel there is a piston ring, 71, which prevents escape of water when the gun is working, and there is a valve, 72, which seats itself, preventing escape of water when the gun is not firing and the barrel is home.

By taking hold of the handles, 36, the gun may be pointed in any direction and controlled as freely as the discharge pipe of a common fire engine hose, while the thumbs fall naturally into the required position for the instantaneous manipulation of the trigger. Thus a stream of bullets is under the perfect control of the

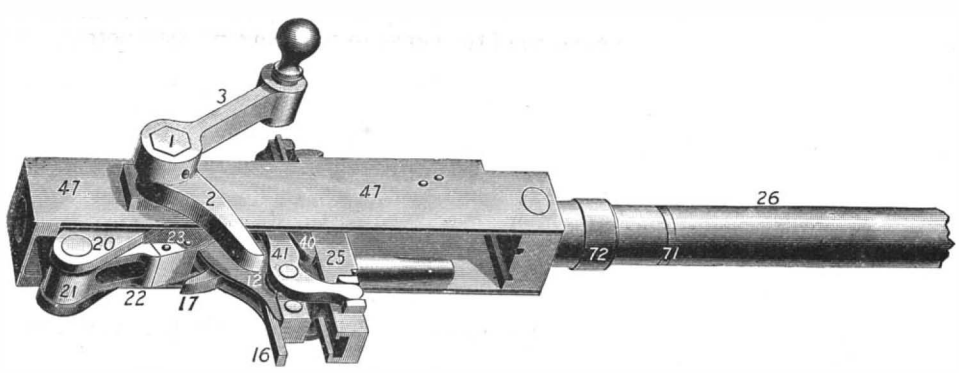

Fig. VI.—THE RECOILING PORTION OF THE GUN.

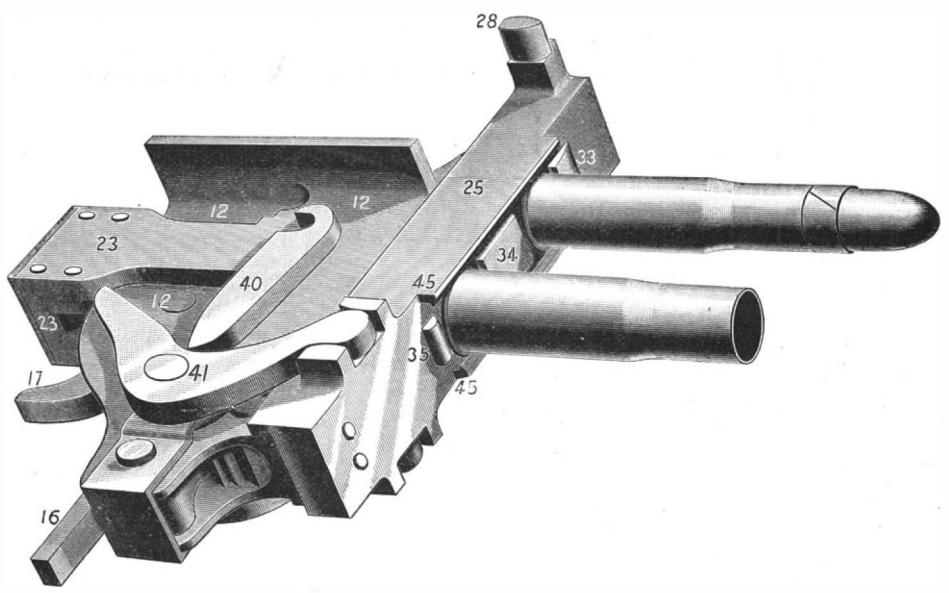

Fig. VII.—REMOVABLE BREECH BLOCK, CARTRIDGE CARRIER, AND LOCK.

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gunner, and may be directed instantly at any desired angle of elevation or depression or spread over any area. By means of sights, 80, 81, as accurate aim may be taken and as good a target made as with any rifle. The rapidity of fire of the gun ranges from 600 to 700 shots per minute, according to the type of cartridge used.

Natural History Notes.

The Lethargic Sleep of a Swallow.—At a recent meeting of the Society of Naturalists, says *La Nature*, Mr. Leroux made a very curious communication upon a subject that has many times been discussed, that is, the possibility of swallows and martins passing the entire winter in a deep sleep comparable with that of hibernating animals. Mr. Leroux exhibited to the society a live swallow, and told its history. The bird had been knocked down by a coachman's whip last October, had fallen into the mud, and was unable to resume its flight. It was picked up by a child, washed, and wrapped up in a roll of wadding, which was put into a drawer and forgotten. A few days before Mr. Leroux made this statement, the roll was taken out by accident, and the bird was found alive, but plunged in a lethargic sleep. The bird was awakened in the presence of the society and set at liberty.

Algæ Parasitic upon Mammals.—Some years ago, the greenish color of some of the sloths was attributed to the presence of an alga upon the hair. Madam Weber von Bosse has recently described two genera and three species of these parasitic plants. The new genus, *Tricophilus*, is green, the other, *Cyanoderma*, with its two species, is violet.

From 150,000 to 200,000 individuals of these algæ may occur upon a single hair.

The Nest and Eggs of the Alligator.—Dr. S. F. Clarke thus describes the eggs of the alligator in a recent number of the *Zoologischer Anzeiger*. The eggs and young alligators are such common objects in the shop windows in many of the Southern States, that it appeared to be a simple matter to secure the eggs at the right time and in abundance. It proved, on the contrary, to be very difficult. I was assured by various hunters in Florida that each month from January to September inclusive was the only month in which the alligators lay their eggs, and this resulted in my having to make two journeys of over twenty-six hundred miles each.

The nests vary much in size, the largest being about 2½ meters in diameter at the base, and 80 cm. high in the central part, the whole having the shape of a rounded cone. They are located generally on a slightly elevated place, which is higher by a meter or slightly more than the surrounding level, and covered with a thick growth of palmettos, mangroves, magnolias, etc. These are called "hummocks" by the natives. On one side of the hummock at least, in some cases on all sides, is a pond from one to two meters in depth, and in the bank, under water, the female alligator digs a cave, which in some cases extends three meters under the hummock, and which is always close to her nest. The nest is made by scratching together a great pile of dead leaves and twigs and humus which forms the surface of the ground, and which is arranged with some care. The inside is made of the more finely divided—almost powdery—material of the deeper layers of the top soil, while the outside, even to the top, is covered with twigs and leaves which are whole or but little broken, and with many of the long, unbroken leaves or needles of the southern pine. The eggs are deposited about 20 cm. from the top, and in the nests were found lying on top of one another, making rows or layers, with the fine humus filling all the interstices. The top of the nest is always exposed to the sun.

Dr. Clarke describes the eggs as very difficult to manipulate, as the shell membrane is tough, and the white very sticky.

The Origin of Sweet Corn.—While the history of the origin of the sweet variety of Indian corn shows it to be quite modern, its existence seems to have been known in New England as early as 1779, when a few ears found among the Indians on the Susquehanna were brought to Plymouth by an army officer.

In a very exhaustive history of Indian corn by Dr. Sturtevant it is stated that sweet corn is not referred to by Jefferson in his "Notes on Virginia," in 1781, nor by Thorburn in 1817, nor by Fessenden in 1828. In 1832 "sweet or sugar corn" is mentioned among garden vegetables by Bridgeman. In 1851 Buist mentions two varieties. In 1853 Salisbury says of the "early sweet corn," the variety introduced by Captain Bagnol, of Plymouth, that one kind has a white and the other a red cob. In 1854 Schenk mentions the extra early, the eight-rowed sweet and Stowell's sugar, which had been brought into notice within a few months. In 1858 Klippart mentions in addition the mammoth sugar. In 1866 Burr describes twelve varieties. The seed catalogue of Thorburn in 1828 offers one variety, the sugar or sweet; in 1881, sixteen varieties; in 1888, twenty-six varieties.

However this sort, as distinguished from Indian corn, may have originated, it has furnished a notable example of the influence of cultivation, until it has become an indispensable article for the table in its season, and one of the most highly prized vegetables for canning. So numerous are the present varieties that from twenty to thirty are usually advertised by leading seedsmen.

Podophyllum peltatum.—In a communication to the *Journal of Botany* on a new Japanese genus of *Berberidaceæ*, Mr. T. Ito takes occasion to state that the occurrence of *Podophyllum peltatum* in Japan is beyond a doubt, it being found in the province of Shinamo, thus constituting another habitat for this plant besides those on the American continent, and affording another example of the similarity of the flora of Japan and the Atlantic coast of the United States.

Wood Cloth.

Mitscherlich has applied the bisulphite process for reducing wood to the production of a fiber from wood which can be spun.

Thin boards or laths free from knots, but of any desired width, are cut into strips in the direction parallel with the grain, and are then boiled in a boiler containing a solution of sulphurous acid or bisulphite. This boiling effects disintegration without requiring that the strips of boards shall be reduced to very small pieces. After boiling the wood, it is dried in the open air or in specially constructed drying rooms. By thus drying the product, the fiber, which is originally very weak, and tends to break at the slightest strain, becomes comparatively strong and does not resume its very breakable condition on the addition of water. The operations are carried out as follows:

The damp masses on the frame are transferred to a traveling endless cloth, which leads them to a pair of rollers, which may be plain or provided with corrugations in the direction of their length, the ribs of the one roller being made to gear into the recesses of the other one, whereby they effect a simultaneous strong bending and squeezing of the masses. The cutting of the material in passing through the corrugated rollers is avoided by causing the endless cloth to pass over the lower roller and by placing a canvas covering around the upper roller. The pressed masses fall from these rollers on to a second endless cloth, which conveys them to a second pair of rollers, from which they are conveyed to a third pair, and so on, they being preferably pressed in this way six times. By continued treatment of the wood the fibers become at length so pliable and isolated from each other that they can be employed directly for coarse filaments. For obtaining a perfect isolation of the fibers, however, without material deterioration, these operations alone are not suitable, and their special purpose is to loosen the fibers in the transverse direction, so that in the following operation a thin, long fiber may be obtained. For this purpose the boiled and pressed masses are completely dried. After drying they are combed in the direction parallel with the fibers by means of devices provided with pins or teeth, in a manner similar to the operations for combing flax, cotton, etc., but with the difference that the pins or teeth of the apparatus must be made very strong. The separation of the extractable matter from the fiber produced by boiling the gums and soluble organic matter can be effected at any time. It is, however, preferably effected after the fiber has been spun into threads, etc.

The Cocoanut Palm.

The government press at Madras recently issued "A Monograph on the Cocoanut Palm, or *Cocos nucifera*," by Dr. John Short, which, the introduction tells us, was written at the request of the Director of Revenue, Settlement, and Agriculture. The author begins, says *Nature*, by pointing out the area of distribution of the cocoanut tree. It is indigenous in the East, and is now largely cultivated on the coasts of India and Ceylon, and in the islands of the Eastern Archipelago. There are as many as twenty millions in the southwest of Ceylon. The palm frequently grows wild in distant and isolated islands, whither the germ has been borne by the sea, the thick fibrous padding around the nut protecting it from the action of the water. So we constantly see that coral reefs, as soon as they make their appearance above the surface of the water, are taken possession of by these trees. The seashore is the home of the palm; it grows quite down to the water's edge, and is in many places constantly washed by the waves. Thus, along the Brazilian coast for a distance of nearly 280 miles, from the river San Francisco to the bar of Mamanguape, these trees extend. We also, however, find them far inland, and at the height of several thousand feet above the level of the sea. At Bangalore they flourish and produce fruit in abundance at a height of 3,000 feet above the sea level. From a dietetical and economical point of view, the cocoanut palm is a most valuable plant; sugar, starch, oil, wax, wine, resin, astringent matters, and edible fruits are its gifts to man. An alluvial or loamy soil is the most suitable for planting it, and no more than eighty plants an acre should be planted to get the maximum amount of fruit possible. Nuts obtainable from trees of from fifteen to thirty years old are the best for planting. There are numerous varieties of this tree, there being as many as thirty in Travancore alone. One dwarf variety bears fruit when it is only two feet in height. Toddy is the sap of the cocoanut palm, and when the toddy drawer wishes to get out the sap of the tree, he binds the flower spathe tightly with fibers of the tree, and beats it twice a day for three or four days with a short stick. The top is then sliced, and as soon as the sap begins to flow, a vessel, either earthen or made of bamboo, is tied to the spathe to receive the sap. The spathe is kept bleeding by making a fresh wound in it each day. The fluid, when fresh, has a pleasant taste, and is slightly aperient. When kept for a few hours, it ferments and becomes somewhat intoxicating, and it may then be distilled into spirits or vinegar. With bakers it takes the place of yeast. The quantity of toddy taken out varies with the age and locality of the spathe, but the average quantity obtained for two or three weeks is three or four quarts every twenty-four hours. The liquid is also boiled down into a coarse kind of sugar called jaggery, which is either converted into molasses or refined before fermentation sets in into white or brown sugar. In some places the occupation of toddy drawer is a hereditary one. Their mode of work is very simple, but is extremely dangerous. A thong made of bullock or buffalo hide, from 3 to 6 inches in width, and long enough to surround the tree and the body of the climber, is fastened with a peculiar kind of knot. The worker then stretches the thong to its utmost by throwing his whole weight on it, and draws up his legs. He has a ring of rope of palmyra fibers around his insteps, which allows him to grasp the tree between his heels. While his left hand is pressed against the trunk he shifts the thong up the tree with his right and draws his body up with it.

"Cocoanut day" is celebrated in most parts of India during the full moon in August. On that day numbers of nuts are thrown into the sea as an offering to the Hindoo gods. Occasionally one meets with deformed nuts, consisting of the husk with small deformed nuts having no kernel inside. The natives attribute this blighting of the fruit to the tree frog (*Polypedates maculatus*) which, by smelling the flower, can prevent the fruit from coming to maturity. The kernel of the nut is frequently made into ornaments for the hair, or necklaces. The plants, Dr. Short says, are subject to disease from two opposite causes: first, from too much moisture, as in swampy soils, where the fronds are usually small and ill-formed, and the fruit scarce; secondly, from lack of moisture, where the soil is hard and dry, the sap-bearing vessels shrink and the plant perishes. Among the insects and animals destructive to the palm may be mentioned the *Calandra palmarum*, or cocoanut weevil, which eats its way into the heart of the tree, and forms its cocoon there; the *Butocera rubus*, or cocoanut beetle; the *Oryctis rhinocera*, or rhinoceros beetle; the *Pteromyes petaurista*, or flying squirrel; the *Sciurus palmarum*, or common striped palm squirrel; the *Pteropus edwardsi*, or flying fox; and the *Paradoxurus musanga*, or tree dog. The rat family is very destructive, particularly in the Laccadives. It is exceedingly difficult to get at these rats, they make to themselves so many hiding places among the trees. Rat hunts are, however, occasionally got up, and to these all the inhabitants turn out with sticks and poles. While some of the hunters climb the trees and drive out the rats, the rest surround the trunks and kill the animals as they rush down. On some of these occasions thousands of rats are killed. The people, being Mohammedans, cannot be induced to keep dogs.

Horse Railway Strikes.

The citizens of New York and Brooklyn have lately been subjected to the dangers and annoyances of a strike of the car drivers and conductors of all the principal lines of the horse railways. It was prolonged for a week or more, during which mobs of idle men roamed about the streets, threatening violence and doing injury to person and property; but they were repressed and cowed to a great degree by the activity of the police. The strikers numbered several thousands, and say they struck because so ordered by their head committee; and the latter gave as reason their dislike of a regulation adopted by one of the companies in New York and something they disapproved of, done by one of the Brooklyn companies.

Floated by Means of Dead Cattle.

It has been said that every work of invention has its parallel in nature. But it would not be anticipated that the method of raising sunken steamers by forcing air into casks which have been secured to them would find such a parallel. Yet such has been the case on the Ohio River, where the steamer Robert B. Carson sank near Evansville, Ind., drowning thirty head of cattle that were confined on the lower deck. Efforts to pump the vessel out were not successful, and the boat was abandoned. A few days later, however, it was found to be floating, the fact being that the putrefying car casses of the cattle had become inflated by the gases generated in putrefaction, and their combined buoyancy was sufficient to raise the steamer again.

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THE NICARAGUA SHIP CANAL.

(*Continued from first page.*)

matters, that its passage has been delayed, the bill being finally sent to a conference committee of the two houses. The technical objections had been made mostly in the House, and these were largely receded from, the House adopting the report of the conference committee on the 6th inst., by the large majority of 177 to 60. On Feb. 7 the bill passed the Senate, and is now in the hands of the President, awaiting his signature. By its provisions the entire expense of the undertaking becomes a matter of private enterprise, and the investment of private capital, undertaken under concessions from the states of Nicaragua and Costa Rica, and in pursuance of treaties of those states with the United States.

The illustrations given herewith, with profile and bird's eye views of the route of the canal, and Central American views, graphically set forth the most important features of the undertaking. The total distance from ocean to ocean is 169·8 miles, of which 56½ miles is by lake, 84½ by river and basin navigation, leaving only 28·8 miles of actual canal. The summit level is at an elevation of 110 feet above the sea, the length of this level being 152 miles. There are six locks in all—three on the Atlantic and three on the Pacific side of Lake Nicaragua. The greatest cut through rock is three miles long, with an average depth of 120 feet.

This lake is deep and unobstructed, has a watershed of 8,000 square miles, and the San Juan River, through which the lake now has an outlet to the Caribbean Sea, is already navigable for light draught steamers throughout most of its length, requiring but little labor to deepen it. This river discharges at its lowest stage, near the close of the dry season, 984,096,000 cubic feet per day, or an amount of water more than eight times greater than it is computed will ever be needed for the lockages. From Greytown the sea level is carried 12 miles, to the site of the first lock, which has a lift of 31 feet, above which is a basin two miles long, formed by damming the lower waters of the Deseado River. At the end of this basin are locks 2 and 3, with lifts of 30 and 45 feet respectively, to the summit level, by which clear navigation will be afforded, as shown in the profile view, to within three miles of the Pacific coast. Locks 4 and 5 have a total lift of 85 feet, and lock 6 has a variable lift, depending on the state of the tide, which has a mean rise and fall on the Pacific side of about 6 feet. The size of each lock is 650 × 70 × 30 feet, thus allowing for the lockage of the largest vessels afloat, such as the Etruria, the Umbria, the City of New York, etc.

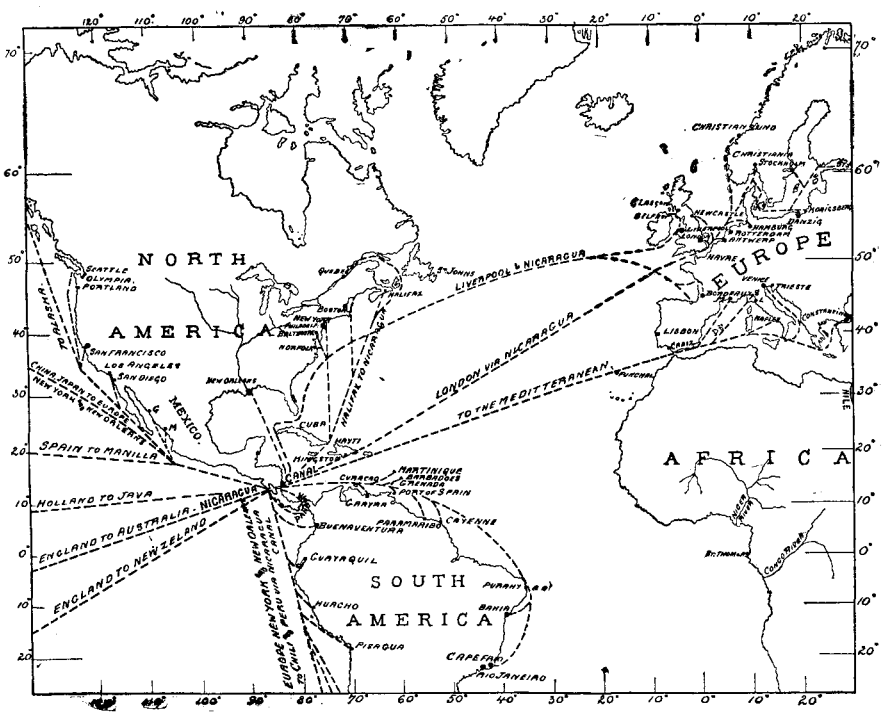
The canal will be, throughout, of a depth of 30 feet, while its least width, at bottom and top, in rock formations, will be 80 feet. In earth excavations the bottom width will be 120 feet and width at the top 180 feet, while in sand and loose material the bottom width will be 120 feet and the width at the top 360 feet.

Besides the construction of the locks, the leading engineering features of the work will be the construction of the two harbors, the one at Brito on the Pacific coast, and the other at Greytown on the Atlantic side, and the damming of the San Juan River for the purpose of raising and maintaining the level of Lake Nicaragua and the river for the long stretch at the summit level of 110 feet, with the formation of minor artificial basins at different levels, by means of dams and embankments. The harbor of Greytown was formerly open to vessels of considerable draught, but has almost been closed by sand bars; the surveys show, however, that the expense will be but moderate, by jettying with brush and pile, and finally strengthening of stone, of making an entrance for vessels of 30 feet draught to an amply protected and safe harbor, on which will be ample wharf facilities, and which will also be the terminus of a railroad to extend along the line of the canal. The harbor at Brito, on the Pacific coast, will require the construction of two break-waters, to give protection from the swell of the Pacific, while the harbor itself will have to be largely excavated, the excavation consisting of the deposits of the Rio Grande. The dam across the San Juan River will be 1,500 feet long by 65 feet high, backing up the waters of the river to a height 58 feet higher than they are now. By this means a lock and a large amount of dredging is saved, as compared with what was required by the earlier surveys. A further improvement of the later surveys is that on the Pacific side a dam will be made across the Rio Grande, 2,100 feet by 80 feet, by which the valley of the upper Rio Grande and the Tola will be flooded, leaving only a low continental divide of about 8½ miles to be cut through from the Tola basin to Lake Nicaragua, and a cut of three miles to the Pacific.

There have been several surveys for an interoceanic canal by way of Lake Nicaragua, the great length of free navigation afforded by that lake, its inexhaustible supply of water for lockage purposes, and the long stretches of the San Juan River which could be utilized to save excavation, with the comparatively low elevation of the back-bone ridges on either side, especially commending this location above all others. Chief Engineer A. G. Menocal, of the U. S. Navy, with Engineer R. E. Peary, as his principal assistant, and a numerous staff, made such a survey in 1885. Since then the present Nicaragua Canal Construction Co. has, under the general management of Commander H. C. Taylor, of the U S. Navy, been formed, and, in the latter part of 1887, sent out a well equipped expedition which has definitely located the canal and mapped out the line and its vicinity with engineering exactness. Careful borings were made along the whole distance, and the nature of the materials to be excavated are now clearly known, in kind as well as quantity. There is a long stretch of dredging back of Greytown and a deep rock cut at the divide on the east side, while on the west side the cutting is mostly through ordinary ground, with dredging and low ground excavation.

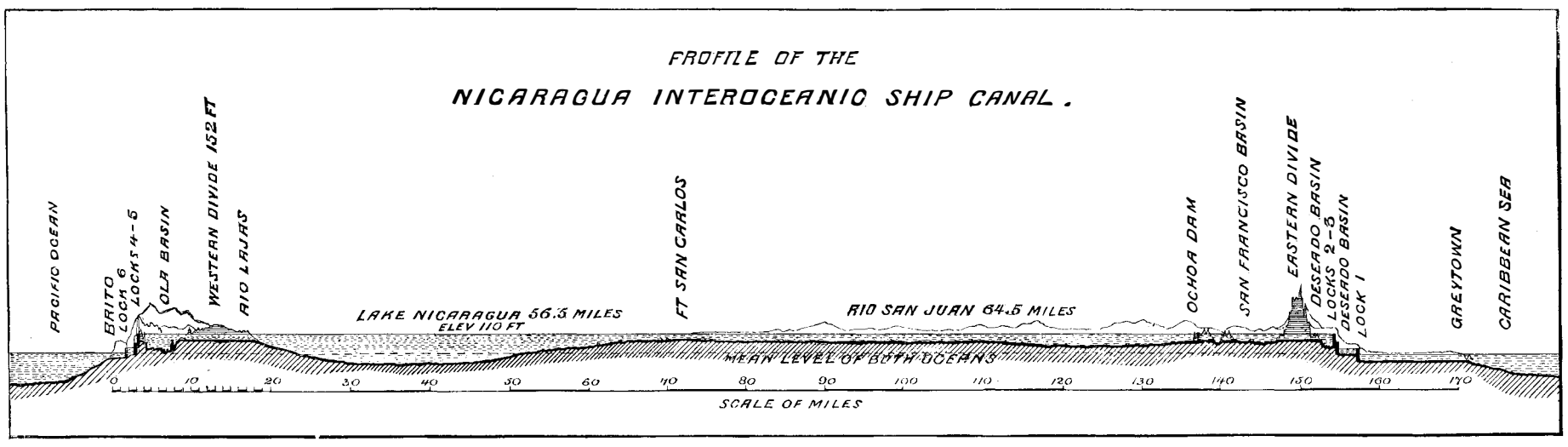
The estimated total cost of the work by the surveying expedition of 1885 was $50,000,000, and $15,000,000 for contingencies, or $65,000,000 in all. The later surveys practically confirm these estimates, and it is said that the whole work can be easily completed so that the canal will be open for navigation in 1895. These figures, it will be remembered, are the result not of one, but of several, very careful surveys, although they look surprisingly small by the side of the amounts already expended on the Panama Canal, for which that company's obligations to-day amount to over $400,000,000. with annual interest and fixed charges of about $22,000,000.

As to the climatic conditions under which work upon the canal will be carried on, it would seem that nothing could be more favorable, temperature tables for two years, taken near the head of the lake, showing a maximum of 93° and a minimum of 65°. For some ten miles back from the Atlantic coast the line will lie through swamps and lagoons, but here the work will be done mostly by machinery, and the climate in general is an equable and almost a temperate one. In the 49 engineers and 150 men in the employ of the company during the last survey, there was not a single cases of serious sickness, although most of the members were, from the nature of their occupation, almost daily exposed to constant wettings. The country is said to be rich in minerals, and cocoa, indigo, coffee, and fruit are the principal agricultural products. One of our illustrations gives a familiar picture of native life. There are but 45 whites and 5 negroes to every 1,000 of the population, the majority of whom are Indians of unmixed blood, the total population of Nicaragua being 250,000.



MAP SHOWING PROBABLE PATHS OF STEAMERS.

The effects upon the world's commerce, and upon that of the United States in particular, of the opening of the Nicaragua canal route is a matter in which even the most careful calculations are almost certain to be far below the reality. The canal itself will certainly have advantages over one at Panama, in being in a healthy climate, and in the heart of the northeast trade winds, where it offers especial convenience to all sailing craft, both in the Atlantic and Pacific. The trade between all our southern ports, especially, and those on the west coast of both North and South America, should be wonderfully stimulated, besides the large European traffic which the canal is certain to attract. It is calculated that on the basis of present commercial conditions there will be six to seven millions of tons of shipping annually ready and anxious to use the canal, and pay a revenue in tolls of $8,000,000, while the cost of maintenance of the canal, after building, is estimated at $1,000,000 annually. It will be at once seen that these figures, as to both the cost of construction and the probable revenue, render the outlook for the financial success of the undertaking extremely favorable



PROFILE SHOWING LOCKS, DAMS, AND DEPTH OF CUTTINGS.

Vaccination.

In Paris, where the law requiring vaccination is feebly enforced, the mortality from smallpox ranges from 136 to 10·1 to the 100,000 inhabitants, while in the principal German cities, where the vaccination laws are rigidly enforced, the death rate is but 1·44 to the 100,000 inhabitants. London, under compulsory vaccination, has a death rate from smallpox of but 0·6 to the 100,000 inhabitants. On the other hand, in the Canton of Zurich, in Switzerland, since the compulsory vaccination law was repealed in 1883, the death rate from smallpox has risen steadily from 8 to 85 to the 100,000 inhabitants.

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RECENTLY PATENTED INVENTIONS.

Agricultural.

CULTIVATOR. — William F. Berry, Blanchard, Iowa. This is a machine which can be readily adapted for cultivating corn or potatoes, or plowing in wheat or small grain, the cultivator blades being adjustable to one side of the shaft or the other, to control the throwing of the dirt either way.

CHECK ROWER. — George L. Banks, Fall River, Kansas. This is a check rowing attachment for planters, which may be expeditiously reversed from side to side, and readily manipulated, the invention covering a novel construction and combination of parts designed to afford a simple and very effective device.

SEED GRADER.—William Minnigh, Bradleytown, Pa. This invention covers a novel construction and combination of parts in a simple and durable apparatus designed to effectually remove the larger cockle from wheat, and sort and grade the sound grain, the device having a casing and fan with longitudinally adjustable sorting chamber having a series of compartments, and other peculiar features.

STALK PULLER.—George W. Rogers, Baltimore, Md. This is a device having an extracting wheel mounted in a suitable frame, whereby, when the apparatus is driven over the rows, it will effectually clear the ground of all stalks of cotton or corn, and leave the field in proper condition for the plowing and sowing of another crop.

TRACTION WHEEL.—Le Roy O. Drew, Carthage, Dakota Ter. This is a wheel adapted to mowing machines, reapers, and other vehicles, and is made with an endless chain consisting of a series of pivoted links, each provided with parallel track plates, supported upon a frame, one link after another passing down on to the ground in front as the machine is drawn forward.

HOE.—Robert McCullough Brown, Fort Gaines, Ga. This invention covers an improvement in hand hoes to be used in cultivating gardens, and has a blade whose cutting edge is curved downward, while its shank extends rearward in the same plane with the blade, whereby it is adapted to take into the soil when the hoe is drawn forward and ride over the soil when the hoe is pushed backward.

HAY OR GRAIN FORK.—William H. Lander, Pendleton, Oregon. This fork has a cross head with pivoted clutch hooks, and a trip block above provided with a hook catch and trigger with trigger rope, with other ropes, for loading hay or grain upon a stack or wagon, or into the upper story of a barn, by means of a derrick.

Mechanical.

MINING DRILL.—William H. Jenkins, Philadelphia, Pa. Combined with a drill rod having a lifting pin is a novel form of operating cam, with other novel features, making a drill of great capacity, with mechanism for operating it of such character as to adapt the drill to all classes and conditions of rock, in which it is readily adjustable, the invention being an improvement on a former patented invention of the same inventor.

SHARPENING GIN SAWS.—William Behan and Paul Friensehner, Texarkana, Ark. This invention provides a feeding device for the teeth independent of the filing devices covered in a patent formerly issued to the same inventors, whereby the teeth of saws of varying diameters will be properly fed to give regular and uniform size to each tooth without reference to the number of teeth in the saw.

FURNACE. — Fradelshon Harris, St. Louis, Mo. This furnace is constructed with a water-containing vessel arranged adjacent to the fire chamber, in connection with an air blast adapted to force the vapors into the fire, whereby hot air with water vapor will be decomposed by the heat in the furnace, setting free hydrogen gas to render the carbon of the fuel more available in combination with oxygen.

SEWING MACHINE.—James B. Ivey, Macon, Ga. The machine has a frame adapted to support a reciprocating carriage provided with a fixed jaw and a movable jaw, a treadle or operating device, and other novel mechanism, the saw being designed principally for use in cross-cutting wood billets for chopping to make kindling wood.

WRENCH.—Charles H. Kennedy, Greenburg, N. Y. This invention provides a tool more particularly adapted for use by telegraph and other line wire men, which, while being compact as a small wrench, will also serve as a pair of nippers and a wire-cutting tool.

MOULDING.—Edward Reddy, Little Falls, N. Y. This invention covers an apparatus for making moulds consisting of inner and top and bottom frames adapted to be placed together, in combination with plates to hold the patterns and to be held between the frames for forming the mould, and to be removed from the frames for drawing the patterns.

Railway Appliances.

CAR COUPLING. — James Mutton, Frisco, Utah Ter. Each link consists of a rectangular shaped bar with an arrow shaped head, the inner end of the link passing over a friction roller and reciprocating between blocks, while a guide plate is secured thereto, the coupling being automatically effected whether an approaching link passes over or above the opposing link.

RAILROAD SWITCH. — John Hunter, Maple Bay, Minn. This is a switch which may be automatically operated by the engineer from the cab of the locomotive, the pivoted switch rails having a rack connecting their free ends, the gear of a rock shaft engaging the rack, and vertically movable plates mounted outside the main rails being connected with the operating shaft for rocking it in opposite directions.

Miscellaneous.

SHUTTER BOWER. — John J. Taylor, Philadelphia, Pa. This invention covers a novel construction and combination of parts in a combined shutter hinge and holder which is readily applicable to ordinary windows and shutters, while it is simple, strong, and efficient.

FIFTH WHEEL.—John M. Giraud, Warwick, Md. This invention provides a broad fifth wheel designed to obviate tilting or rocking from any unequal disposition of the load, and one which will be less exposed to dust, sand, etc., than those of the ordinary construction, while no king bolt is needed, and the device is designed to be very durable.

SOUNDER ATTACHMENT.—George H. Carey and William McArthur, Dollarville, Mich. This is a resonator for telegraph relays, to amplify the sounds of the armature lever, combining with a relay or sounder a box of resonant material supported over the armature lever in position to receive its blows, the resonator being made adjustable to be accommodated to the position of the armature lever.

TRUSS.—Joseph R. Meloney, Bloomer, Wis. This device, while intended for use as a simple and effective truss, is designed to readily yield in conformity to the actions of the body, or the parts with which it is brought into contact, the invention covering various novel features and combinations of parts.

BOSOM PAD.—Edward K. Warren and Joseph H. Ames, Three Oaks, Mich. This is a dress and garment form consisting of a covering or facing of cloth of single thickness, having stitched pocket-like plaits in which are placed elastic ribs made of material that will not corrode, the whole being drawn together and a marginal binder applied to the gathered portions.

SHIRT IRONING TABLE. — James H. Mount, Jamesburg, N. J. This invention provides a shirt ironing board to be permanently or detachably connected with the table, and having yoke and shirt clamping devices, with neck band shaping device, designed to have greater durability, effectiveness, and convenience than ordinarily possessed by devices of this character,

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BUILDING EDITION.

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1. Elegant plate in colors showing elevation in perspective of a suburban club house, with floor plans, sketch of entrance, etc. Munn & Co., architects, New York.
2. Plate in colors showing perspective and plans, with details, for a comfortable country dwelling. Cost three thousand five hundred dollars. Designed by Munn & Co., architects, New York.
3. View of the Jay Gould tomb at Woodlawn cemetery, near New York city. A most classical specimen of mortuary architecture.
4. A residence at Rutherford, N. J. Perspective elevation and floor plans.
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6. A carriage house for one thousand dollars, lately built at Flatbush, Long Island. Perspective and floor plan.
7. A house for three thousand dollars lately erected at Bridgeport, Conn. Perspective elevation and floor plans.
8. A residence at Orange, N. J. Cost fourteen thousand dollars. Plans and perspective.
9. A block of eighteen hundred dollar frame dwellings at Syracuse, N. Y. Floor plans and perspective.
10. The Galliera Museum, Paris. Half page engraving.
11. Sketches from the Architectural League Exhibition: Proposed memorial campanile for plaza of Prospect Park, Brooklyn, N. Y., Henry O. Avery, architect—The Washington Hotel, Kansas City, Mo., Bruce Price, architect, N. Y.—Towers of hotel at Big Stone Gap, Va., Brunner & Tryon, architects—District school house at Washington, Conn., Rossiter & Wright, architects.
12. Design for a boat house of moderate cost, by Munn & Co., architects, New York.
13. Page of engravings of country residences.
14. Miscellaneous Contents: Restoration of the Doge's Palace.—The broken timber raft.—Raising columns of St. Isaac's Cathedral, St. Petersburg.—Tarred bricks.—Pompeian houses. — Repairing of a well.—Finish for pine.—Architecture as a profession.—Paintwork.—The National Association of Builders.—How best to light our country homes and resorts, illustrations.—Larch lumber.—The Thomson-Houston motor for street cars.—Hints on plumbing and cellars.—The fatal climate of Panama.—Improved hoist for passenger or freight elevators, illustrated.—Clark's new anti-friction caster, illustrated.—Tool cabinet, illustrated.—Universal bevel protractor, illustrated.—California slate.—Pipe wrench, illustrated.—The "Gorton" boiler, illustrated.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(337) B. U., Miles City, M. T., writes: Inclosed please find a copy of analysis of the water we are using for our boiler. It is taken out of an artesian well which we dug to a depth of 258 feet. Before doing so, we were using water from driven wells, but on account of coating boiler badly we had to discontinue it. Boiler about two weeks after using artesian water was perfectly clear of all scales and is like new now. To feed boiler we are using a Monitor injector, which has worked very satisfactorily right along, but commenced to trouble, losing water through the overflow, and finally got so bad that we put on a new one, which after two weeks' use commenced the same things, and is now getting worse fast. There is no sign of any sediment on inside of injector, and so I came to the conclusion that the fault must lie in the water. Now, will you have the kindness to tell me how to remedy the evil, if it can be done, or recommend an injector that will work the water we are using? Also please inform us whether the water is apt to have any bad effects on boiler.

	Grains per gal. of 231 cub. in.
Silica	1·36
Peroxide of iron	0·54
Carbonate of lime	2·27
" " magnesia	1·83
Chloride of sodium	2·01
Sulphate of soda	1·80
Carbonate " "	60·40
	70·21

A. There is nothing shown in the analysis of the water that would injure the injector. Examine the water from the well for sand, by settling in a barrel or tank, also examine the inside of injector nozzles for marks of cutting, probably by sand. You may also look for sand in the bottom of the boiler. It takes but little sand to spoil an injector. If sand is found, feed the injector from a settling tank. The boiler should be often blown down to prevent accumulation of solids. The water is harmless in its action upon the boiler.

(338) A. P. B., Fort Madison, Iowa, writes: We have recently completed an artesian well at our mill here, and would like to know if the water (which rushes out at the surface at the rate of 476 gallons per minute and shows a pressure of 111 pounds per square inch) would be injurious to our boilers, brass fittings, iron and copper piping, etc.? Below I give you an analysis of its contents as furnished by an expert chemist:

	Grains per U. S. gallon.
Organic matter	0·180
Silica	0·390
Aluminum and iron oxide	0·807
Bicarbonate of lime	14·318
" " magnesia	7·817
Sulphate of lime	10·217
" " soda	40·071
Chloride of "	41·329
Total solids	151·129
Chlorine combined	24·940

A. The total solid constituents, amounting to nearly 10 per cent of the solid constituents of sea water, will make it necessary to blow off the boiler often and in larger quantities than when good water is used. There is nothing in the water that is injurious to the boiler. Wherever there are leaks, as about the water gauge, gauge cocks, etc., there an incrustation will form on the outside by evaporation. That will also be harmless, and may need often cleaning.

(339) I. B., Leadville, asks: What is the breaking torsion strain on a wrought iron pipe three and one half inches outside diameter with metal twenty one hundredths of an inch thick, and one hundred feet long, fastened at one end and the strain applied at the other end? A. The torsional strength of 3 inch wrought iron pipe, 3½ inches outside diameter, is 1,392 pounds at 5 feet from the center. When coupled in a length of several pieces by welding, a deduction of 5 to 10 per cent should be made in the above figures; when coupled with the ordinary screw couplings, at least 50 per cent should be deducted for the value of the joints.

(340) G. S. writes: I have made a simple electric motor. In running it with battery need I make a new solution every time I run the battery down, and how must I connect the cell? A. The simple plunge battery described in SCIENTIFIC AMERICAN, August 20, 1887, will run the motor very well. A new solution is necessary every time it runs down. Connect the cells in series.

(341) E. L. D. asks: 1. How can I melt and make a moulding of hard rubber, such as combs, handles, etc.? A. You must use unvulcanized India rubber, and vulcanize it after shaping. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 249, 251, 252, which we can send you for ten cents each. 2. Is the spark which sometimes flies off from a man's shoe in striking a walk of stone or any hard substance an electric spark, or is it merely the heat generated by friction? A. The spark is a little fragment of burning iron, detached from a nail in the shoe, by striking the stone and becoming ignited by the heat of friction and impact.

(342) F. G. G. asks: 1. Can electricity be obtained in placing a dynamo in a glass inclosure with all atmosphere taken out? A. Yes. The atmosphere has nothing to do with the action of a dynamo. 2. Can a current of electricity and magnetism be sent through fire, or will it destroy same? A. Induction from a magnet or electric wire can act through fire. There is no such thing as a current of magnetism. A current of electricity needs a conductor, and flame is an exceedingly poor one. The static discharge affects a flame by creating draughts of air.

(343) J. M. H. asks for a formula for writing in white ink on blue paper or any other paper. A. Mix Chinese white with gum arabic solution. This will give a solid body ink. Or use oxalic acid, and upon the proper kind of blue paper this will give a very excellent effect by bleaching the paper. Blue paper adapted for the latter can be found upon the market.

(344) J. J. D. writes: The chord of circle being given, with the distance at center of chord to the circumference (versed sine), how can you find the radius of the circle? A. Add the squares of the versed sine and of half the chord, divide the sum by twice the versed sine, and the quotient will be the radius.

(345) A. R. asks: 1. Will benzine weaken a cord of catgut? A. No. 2. Can any oil or substance be used to replace that dissolved by the benzine? A. Olive or sweet almond oil.

(346) M. & A. write: Could you kindly inform us what is put into gelatine used for moulds to prevent the plaster from burning? A. Oil the gelatine with linseed oil. You can also mix the gelatine with one tenth bichromate of potash and then dissolve in an obscurely lighted room. Make your moulds from this and expose to sunlight.

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(347) F. W. B. asks: I have a Julien storage battery consisting of 3 cells of 6 volts electro motive force; what is the strongest incandescent light that could be operated by it? A. About three candle power. Ask for a six volt lamp.

(348) C. E. W. asks if there is any fulminating or deflagrating substance which can be ignited by the passage of a spark from a frictional electric machine. A. With proper connections gunpowder or fulminating mercury can be ignited by the static discharge.

(349) J. O. N. writes: The cigar lighter consisting of two small nickel plated cylinders, through one a wick runs, which is ignited by the application of a chemical drawn from the other cylinder, has possibly attracted your attention. What is the substance that effects the ignition? A. We have no analysis of the substance, but believe it to be an amalgam of sodium and mercury. The wick, from the accumulation of caustic soda, is supposed to be always damp enough to ignite the sodium.

(350) H. H. F. asks: How may a battery of the cheapest, simplest kind be made and maintained that is capable of shocking a person to the extent that ordinary people generally care to stand? A. Use an induction coil, such as described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 569.

(351) G. D. asks what is the most expansive metal suitable for an incubator regulator. A. Of solid metals, zinc. For heat regulator, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 629 and others.

(352) H. M. P. writes: Can you give me a receipt for bleaching human hair, removed from the head, which will leave it a pure white, without injuring its strength? A. Binoxide of hydrogen is used for the purpose, but artificially bleached hair is invariably of inferior quality.

(353) A. F. W. asks (1) how to put about forty 16 candle power lamps (incandescent) into a circuit so that one lamp can be shut off without interfering with the rest of them. A. If you work from a storage battery, arrange your lamps in parallel, and no further regulation is needed. If you use a dynamo, you should have a self-regulating one. For dynamo construction we refer you to Hering's "Principles of Dynamo Electric Machines," which we can send by mail for $2.50. 2. Also can you tell me in what book or periodical I will find an explanation of the way of wiring a house or building of any kind for incandescent lighting? A. We refer you to SCIENTIFIC AMERICAN SUPPLEMENT, No. 603. 3. What kind and how many cells of battery will it take to run five 16 candle power incandescent lamps about four hours out of twenty-four to the best advantage? A. Use 25 cells of storage battery or 50 cells of quart Bunsen battery with 50 volt lamps. 4. Does the SUPPLEMENT give any information on the storage batteries and how they are made? A. Many storage batteries are described in the SUPPLEMENT.

(354) H. M. T.—You will find very complete tables of planetary elements in "Astronomy for High Schools and Colleges," by Newcomb and Holden, $2.50, which we can mail for the price. From its tables we give you the orbital velocity in miles per second of each of the planets:

Mercury	29·55
Venus	21·61
Earth	18·38
Mars	14·99
Jupiter	8·06
Saturn	5·95
Uranus	4·20
Neptune	3·36

(355) J. V. D. asks: What would be the horse power represented by the tide raising a scow (say 100 ft. by 300 ft. bottom measurement, vertical sides) twelve feet high in five hours? A. If you load your scow so as to displace its area for one foot in depth, its lifting power will be equal to the weight of the water displaced, which is $100' \times 300' \times 62$ lb. $\times 10$ feet, available tide = 19,200,000 lb. for 5 hours' duration. This product divided by the minutes in five hours gives the value of the power for one minute, which is the unit of time for horse power. Thus:

$$\frac{19,200,000}{300 \text{ mins.}} = 64,000 \text{ and } \frac{64,000}{33,000} = 1{\cdot}94$$

horse power, or nearly two horse power, without deducting the friction of machinery for operating the power. We allow 10 ft. travel, because the scow must draw two feet for the full power in rising and just touch the water in falling to make the full power available. This system is expensive for the machinery required for the small power. A far more efficient system is to impound a large volume of water and use a submerged turbine for utilizing the power, allowing the water to flush each way at the turn of the tide.

(356) S. B. M. asks if there is a motor of any kind in use or manufactured which will run 2,300 revolutions per minute and develop 30 horse power. A. We know of none. The velocity is too great for a practical motive power of any kind. A dynamo may run up to 1,500 revolutions per minute, and develop 30 H. P., without heating journals, with care. Rotary engines of the Avery type have run at 1,000 to 1,200 revolutions per minute, developing 30 to 40 horse power. Turbines are made to run 1,500 revolutions per minute, developing 30 or more horse power, with pressure of 100 feet water head. Water motors of the hurdy-gurdy type may have very high speed under great pressures from the jet nozzle, possibly reaching the figures that you name.

(357) C. E. M. asks: I intend to put a keel condenser on a small steam launch. Can I proportion my independent feed pump so as to give a vacuum without an air pump, and if so, how perfect if all joints are tight? A. You cannot obtain a vacuum with an ordinary feed pump. Possibly a partial vacuum of 3 to 4 lb. may be obtained under favorable arrangement, provided the condenser is large enough.

(358) J. K. F. says: Please inform me, through your Notes and Queries, the largest gun made, where and by whom made, the weight of gun and projectile, caliber, the weight of charge of powder, and the greatest distance the projectile has been thrown. A. The largest gun was made by Krupp, weighs 118 tons, is 45 feet long, 16 inch bore, rifled, and throws a projectile of nearly one ton, eight miles, with a charge of 600 lb. prismatic powder. Others of still larger dimensions are in course of manufacture. The greatest range claimed is 12 miles, from a 9 inch gun in England, with an elevation of 37°.

(359) C. E. says: The State of California is about to enact a law requiring all engineers to procure a license. I have been a mechanical engineer for nearly twenty-five years, yet probably could not answer the theoretical questions necessary for me to pass the examination. Will you please inform me what books to procure in order to post myself? A. You will find the desired information in "Questions and Answers for Engineers," by Roper, which we can send you by mail for $3.

(360) R. S. B. asks for information on the following queries: 1. A short and simple formula for ascertaining capacity of cisterns. A. For capacity of cisterns, square the diameter in feet and decimals; multiply the product by 0·7854, which gives the area in cubic feet for one foot in depth; multiply this product by the depth in feet and decimals, and the last product by 7½ for the number of gallons. 2. Dimensions of 100 barrel cistern. A. A 100 barrel cistern should be 8 feet diameter, and 8 feet deep from the spring of the arch. 3. Formula for ascertaining area of ellipse. A. For the area of an ellipse, multiply the diameters together, and the product by 0·7854. 4. It is stated that the cruiser Vesuvius, which has shown a speed of 21·65 knots, is the fleetest vessel in our navy. Is not the Stiletto the fleetest? A. The Stiletto is the fleetest vessel, but does not rank as a war vessel. She is only 90 feet on the water line, and displaces but 28 tons. She is used as a dispatch boat. 5. Is the table on inclosed slip, giving method of ascertaining number of gallons in cistern, and which is copied from a mathematical work, correct and reliable? A. The table is correct to a fraction of a gallon.

(361) C. V. H. asks: 1. How the Leclanche disk battery is made, giving proportion of the ingredients? A. The porous cup is filled with a mixture of graphite and clean sifted binoxide of manganese in about equal parts. The carbon prism is embedded in this mixture. 2. Suppose a rubber cell be used, and the cell sealed, is there anything in the rubber that would interfere with the proper working of the battery? A. No; but gas may be given off in the reactions in the cell, for which in some combinations an outlet should be provided.

(362) E. M. La B. asks (1) how pocket batteries are made, such as are used in connection with the small incandescent scarf pin lamps? A. While a carbon zinc couple wth bichromate exciting fluid would give good results, a metal plate—silver or platinum—is generally used for the negative electrode, to save room. Then as exciting fluid a mixture of sulphate of mercury and water may be used. 2. Also how many cells of simple plunge battery will it take to run one two-candle power incandescent lamp? A. Three or four cells.

Enquiries to be Answered.

The following enquiries have been sent in by some of our subscribers, and doubtless others of our readers will take pleasure in answering them. The *number* of the enquiry should head the reply.

(363) G. W. writes: Will you please inform me through Notes and Queries of the SCIENTIFIC AMERICAN what the rule is in regard to the size or area of smoke stacks for stationary boilers (using natural draught)? I frequently have work of this kind to make, and I think there is a rule in proportion to the area of grate, but do not know what it is.

(364) M. S. O'K. says: We would like your opinion in regard to the following: Does the piston of an engine in theory come to a stop after completing its stroke, or does it immediately start in the opposite direction? It is controlled by the crank pin, which is in continuous motion. We can easily understand that it stops going in one direction, but the question is, does it pause or does it immediately take the opposite direction? In practice, of course, the lost motion of the parts would allow it to pause, but theoretically does it?

(365) S. S. S. asks: Would you kindly inform me through the columns of your paper what are the ingredients of the composition used for making bass-relief signs, used for advertising purposes mostly?

(366) G. T. asks: Will you please find space in your valuable paper to inform me what good, if any, a dome is to a steam boiler?

(367) J. P. W. asks: On a street cable railway one mile long, grade level, the rope (1¼ diameter, weighing 2½ lb. per ft.) was at a speed of 880 ft. per minute; on the incoming rope are nine cars at equal distances, the same number on the outgoing rope, weight of each car and passengers 14,500 lb. What is the pulling strain upon the rope?

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the numbers therein given:

(172) A. D. C.—Safety Valve, etc.—For method of computing safety valve, see answers to enquiries, No. 60, January 26. For removing paint, use strong caustic potash solution in water.

(175) C. S. B.—Air Brakes.—The principles involved in the construction of various air or vacuum brakes are illustrated and described in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 392, 523, 642, which we mail at 10 cents each.

(177) G. H. A.—Clean and Whiten Piano Keys.—Wipe the keys occasionally with a solution of alum. Coal tar varnish is much used for sheet iron, or for a fine varnish thin the japan varnish of the trade with turpentine.

(178) H. M.—Dyeing Clothing.—See a book on the "Dyeing of Fabrics" by Hummel, $2.00 mailed. For eye glasses use dark blue or smoke color.

(180) W. B. D.—Cleaning Shells.—The only safe way is to file, scrape or cut off the outside coat. For cutting, use a chisel or a draw knife, holding the shell with a strap looped through holes in a bench. The acid process is sometimes used where the bright parts can be protected with wax, but it is uncertain in the hands of amateurs. Use oxide of tin to polish.

(181) O. K.—Bicycle Enamel.—Hard baking japan, as sold by the varnish makers, is used for bicycles. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 316, for description of japanning and manufacture of japans.

(182) Student.—Phosphorized Oil is made by dissolving six-tenths of one per cent of phosphorus in cod liver oil. It is called phosphorole, used in phthisis. Consult the Pharmacopœia.

(183) W. J. S.—Green on Pickled Gold.—You will find a variety of receipts in the "Goldsmith's Hand Book," which we can send by mail for $1.20.

(184) C. V. A.—Telescopic Camera.—You do not state the kind of object glass, achromatic or plain, and as you say that the eye piece is a single lens, we are led to suppose that the object glass is also single. With such a telescope we fear that you will have little satisfaction in photographic work. You need an achromatic object glass of excellent definition with a low power Huyghenian eye piece. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 399, for illustrated forms of eye pieces, and Nos. 581, 582, 583 for a series of papers on astronomical telescopes and their object glasses.

(186) E. F. C.—You will be able to do much in the way of theoretical knowledge of electricity and the methods of practical adaptation to light and power. The experience required will be more readily attained in practice after your book studies. Read "Electric Lighting," by Du Moncel, $1.25, and "Electric Motors," by Du Moncel, $3.00, both of which we can mail at the price.

(187) W. S. B.—Fresh Water for Ocean Steamers.—Ocean steamers have surface condensers for utilizing the whole exhaust by condensation and return to the boilers, the deficiency being supplied from the sea. They are also supplied with condensing apparatus for supply of fresh water from steam, direct from the boilers, which with the fresh water carried in tanks make the equipment complete for ship's use.

(188) J. D. B.—Cementing Rubber.—Use rubber cement, which is made by dissolving pure rubber gum in benzine. See SUPPLEMENT, Nos. 249, 251, and 252.

(189) Demagnetizing Watch.—See SCIENTIFIC AMERICAN of October 2, 1886, for illustrated description of the process of demagnetizing watches.

(191) F. L. A. S.—The restoration of cracked oil paintings is the work of an artist. For well defined principles for a belief, see works on mental philosophy.

(196) G. C. H.—The answer to your last question should have been 0·3 or three-tenths of a H. P.

(239) W. M. H.—Firing Red Hot Shot.—The shot is heated red hot in a furnace. A sabot or thick wad made of wood is rammed down over powder. A bundle of damp straw moss or cloth is rammed down to sabot. The shot is then inserted, shoved home, and fired instantly. Not now used, bombs being safer to the gunners and more effective against the enemy.—P. H. L.

(239) W. H. M.—Hot Shot.—In your issue of January 26, query 239, a correspondent asks for the method of firing hot shot. A book prepared by a board of officers for instruction in heavy artillery, for the army of the United States, contains the following instructions for hot-shot firing. The cartridge bags are made of woolen stuff, and the cartridge is inserted choke foremost in a cartridge bag of the next higher caliber and the end folded under. The bags should be examined carefully, and great care should be taken to prevent the powder from spilling or sifting in the bore. The wads are made of clay or hay. Clay wads should consist of pure clay, or fuller's earth, free from sand or gravel, well kneaded, with just enough moisture to work well. They are cylindrical, and one caliber in length. Hay wads should be soaked for ten or fifteen minutes. Before using, the water is pressed out of them. When hay wads are used, vapor may be seen escaping from the vent, on the insertion of the ball, but this is only the effect of the heat of the ball on the water in the wad, so no danger need be apprehended from it. With proper precautions the ball may be permitted to cool in the gun without igniting the charge. The piece, however, should be fired with as little delay as possible, as the vapor diminishes the strength of the powder. In loading, the piece is sponged with great care, and the worm is frequently passed through the bore. As a precaution, a wet sponge should be inserted just before putting in the ball. The muzzle being sufficiently elevated to allow the ball to roll down the bore, the cartridge is inserted, the mouth of the outer bag being foremost, the fold down, and carefully pushed home without breaking it; a dry hay wad is placed in it and rammed once, then a clay or wet hay wad is placed upon it and rammed twice, and finally, if firing at angles of depression, a wad of clay a half caliber in length, or a wet hay wad, is placed on the ball.—L. E. P., Philadelphia.

(239) Hot Shot.—Insert powder cartridge in cannon, cut a sod or turf not less than 4 inches in thickness, fitting the bore of the gun, and ram tightly on cartridge and take aim; on entering red hot ball, roll or push same on the charge and fire immediately. If the aim is downward, add another sod with the ball.—E. S.

(240) Niagara Falls.—1. From the brink to 200 feet back of the Niagara Falls are rapids running over and between bowlders. 2. No level. 3. Velocity of current estimated at 25 miles per hour. 4. Not at the Falls, but at or near Buffalo, where the current is 8 to 9 miles per hour, and sorry to say that the $100,000 premium is a booming humbug.—E. S.

(241) 50 and 75 horse power engine.—If the 50 horse power engine is properly constructed, and more attention is given to the inside than the outside, it ought to do the work satisfactorily. A 75 horse power engine of the same pattern and make as the 50 horse power one would only increase the work of keeping up steam, except it would be of the most economical automatic cut-off make.—E. S.

☞ Books or other publications referred to above can, in most cases, be promptly obtained through the SCIENTIFIC AMERICAN office, Munn & Co., 361 Broadway, New York.

TO INVENTORS.

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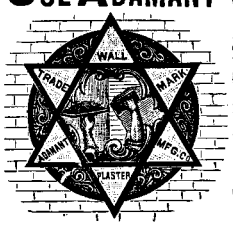

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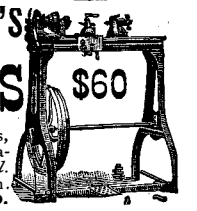

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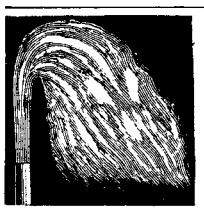

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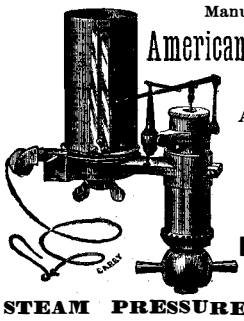

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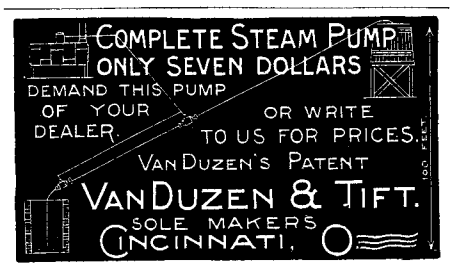

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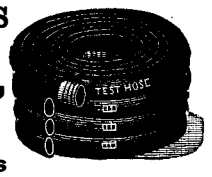

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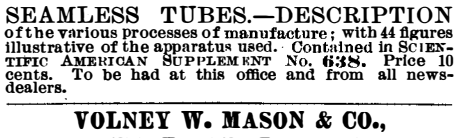

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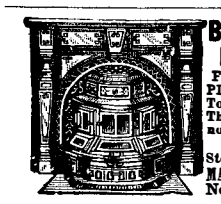

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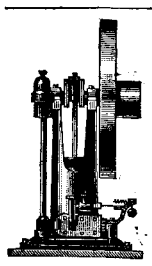

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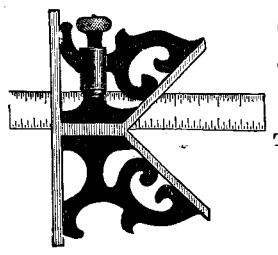

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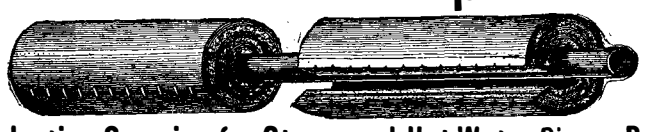

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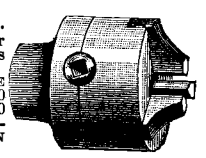

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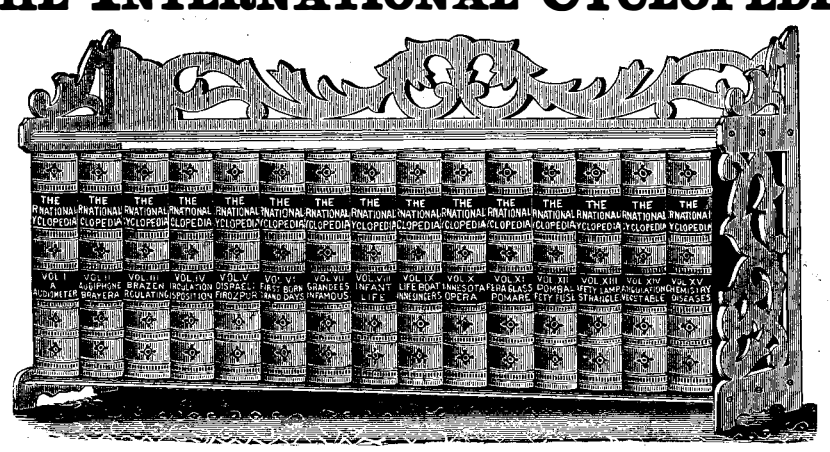

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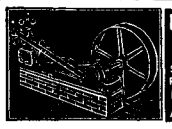

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